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THE GREAT DRY DOCKS AT THE ERIE BASIN.

The largest dry docks in the country, and probably the largest in the world, are located at the Erie Basin, South Brooklyn, N. Y. These docks were built by J. E. Simpson & Co., of New York, and are now under the control of the William Cramp's Sons Dry Dock Co., of this city, lessees. Our engraving shows the docks and their appurtenances in perspective and in detail: Fig. 1 being a view in the engine room; Fig. 2, the general view of the docks; Fig. 3 showing one of the docks while being filled; Fig. 4, the caisson floating away. Fig. 5 is a transverse section of the caisson. Fig. 6 shows the discharge of the pumps, and Fig. 7 shows the dock and the pump connections in section.

The illustration represents the City of Worcester in the smaller dock, and one of the largest ocean steamships in the larger dock. We extract the greater portion of our description from the report of the Board of Inspectors ordered by the Secretary of the Navy. The dry docks are two in number, and of the following dimensions:

Dock No. 1.

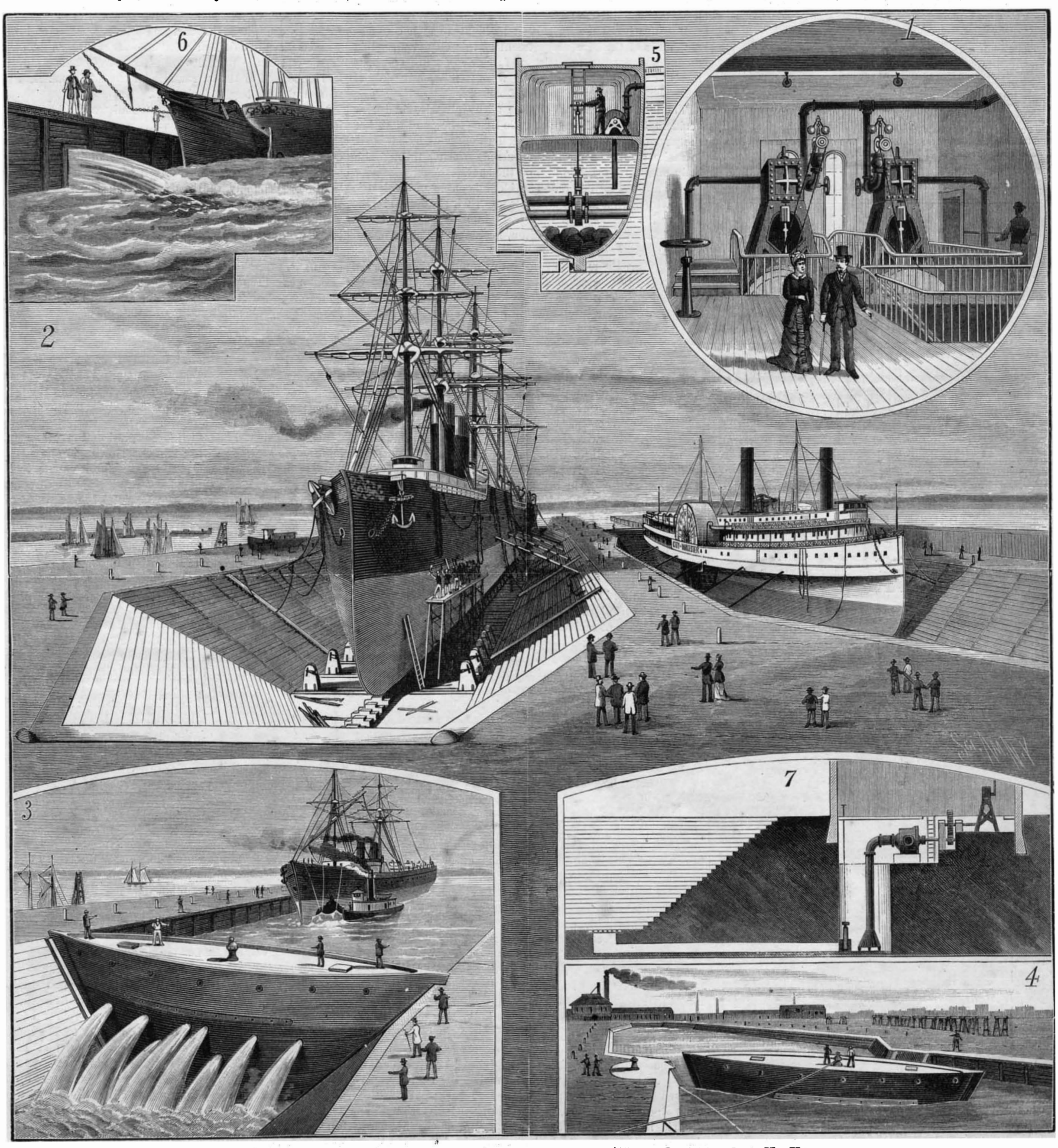
Length over all on coping	540 feet.
" inside of caisson when at outer abutment	510 "
" inside of caisson when at inner abutment	490 "
Width on top in body	124 "
" " floor " "	52 "
" " " at entrance	46 "
" " top " "	100 "
Depth of gate sill below coping	27 "
" " " " " high water	22 "

Dock No. 2.

Length over all on coping	630 feet.
" inside of caisson when at outer abutment	600 "
" inside of caisson when at inner abutment	580 "
Width on top in body	111 "
" " floor " "	46 "
" " " at entrance	45 "
" " top " "	85 "
Depth of gate sill below coping	30 "
" " " " " high water	25 "

The docks are built upon spruce pile foundations throughout, the floor foundation piles being driven in rows spaced three feet from centers transversely, and about four feet eight inches longitudinally, upon which are fitted

(*Continued on page* 20.)



THE GREAT DRY DOCKS AT THE ERIE BASIN, BROOKLYN, N. Y.

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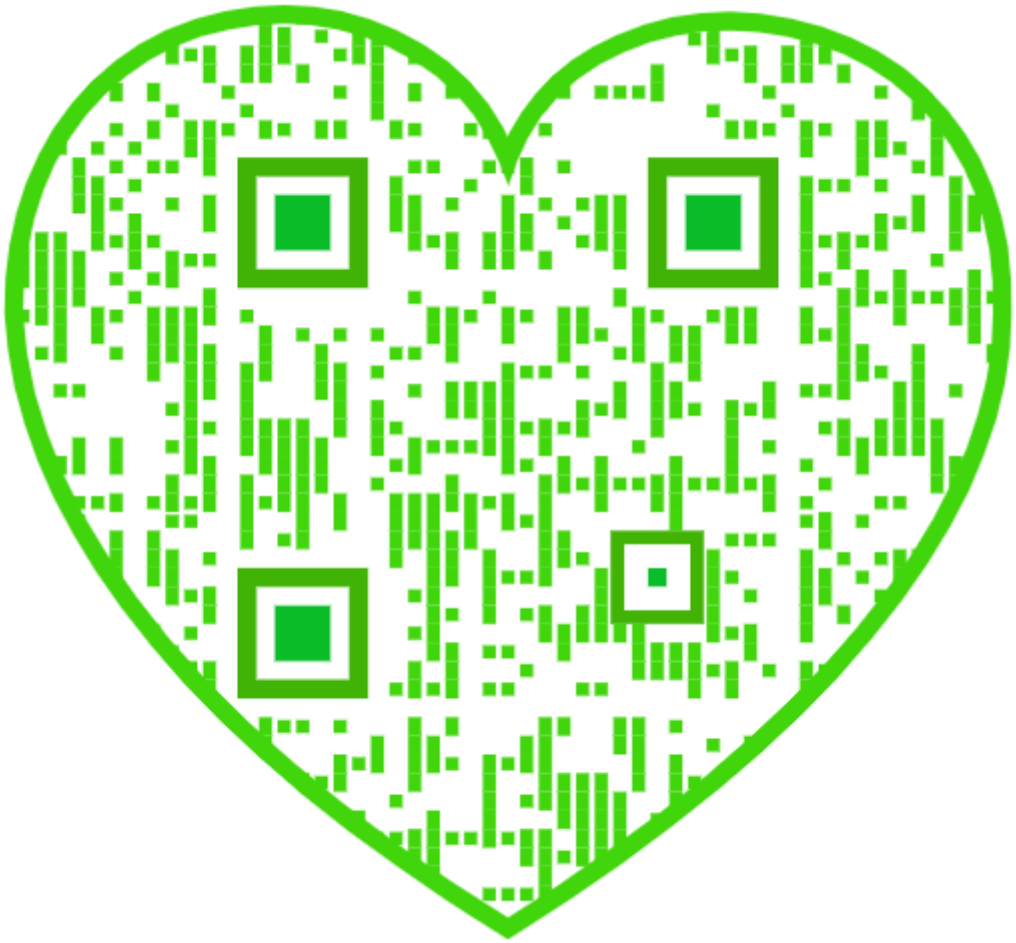

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NEW YORK, SATURDAY, JANUARY 13, 1883.

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PERILS FROM SUSPENDED ELECTRIC WIRES.

The promoters of electric lighting confidently promised at first that the new illuminant would insure complete immunity from the peculiar fire risks and dangers to life and health incident to the use of gas.

The promise has been fulfilled; but unexpectedly, the use of electricity for public lighting has developed a variety of public perils as numerous and serious as any due to illuminating gas, and far more subtle. Scarcely a day passes without some new and surprising development of this character; and though the discovered perils may not always be essential to and inseparable from the use of electric lights, the majority of them certainly are inevitable consequences of the present mode of distributing the electric current by means of wires suspended in the air.

The enormous extension of telegraphic and telephonic communication in this and other American cities has filled the air with electric wires, with connections in almost every house. The wires, and the instruments used with them, are designed for service with currents of small quantity and high tension. Until the introduction of suspended conductors for the larger currents employed in electric lighting, the multitudinous telegraph and telephone wires were no more than harmless offenders against æsthetic propriety. Crossed by electric light conductors they at once become the means of ever impending fire hazard, for the current diverted by the slightest contact with an electric light conductor suffices to heat the coils of telephones and telegraphic instruments to such a degree as to destroy them and at the same time set fire to any combustible matter near at hand.

But this is not the only peril incident to such contacts. An officer of the Fire Department of this city reports that during a recent fire the assistant foreman of a fire company received a severe shock when he went to release the key of a fire alarm box near the scene of the fire.

The inference was that the fire telegraph wire had been accidentally crossed by an electric light wire, and that, had the pavement been damp on which the fireman stood, so as to make good "ground," the current passing through his body might have killed him on the spot.

Only a few days before, an accidental contact of an electric light wire with a fire service telegraph wire resulted in the destruction of the electro-magnets in a dozen fire alarm boxes in Nassau, Liberty, Fulton, Beekman, Greenwich, and Hudson streets.

By spoiling the means of instant communication with the fire service, in case a fire should break out, an accident of this nature is obviously a very serious affair. And quite as undesirable as the interruption of the fire alarm service is the development of a feeling among firemen and citizens generally that the legitimate use of an alarm box involves a peril that may be as sudden and deadly as a stroke of lightning. Telegraphic switch boards and telephonic instruments are similarly made more or less hazardous to use by the same misdirection of electric light currents.

Still more recently, at a fire in Fourteenth street, some broken telegraph wires in front of the burning building fell across an electric light wire, and became entangled with the firemen's hose. It is probable that the heated telegraph wires burnt through the insulating cover of the electric light wire, so as to establish contact. At any rate, when a fireman went to free the hose from the wires he received a severe shock. Enough of the current of the electric light wire had been diverted through the broken telegraph wires to the ground to make it unpleasant if not dangerous to handle them.

It is submitted that, so long as the present system of suspending electric light wires on poles is maintained, one or more members of each fire company should be instructed in the art of manipulating electric conductors, so as to be able to cut and secure any electric light wires that the firemen might encounter or with which broken telephone or telegraph wires might be dangerously fouled. The fire authorities suggest that the engine houses be telephonically connected with the electric light stations, so that an electrician may be called when needed for such service. But that method would be too slow and uncertain; the cutting and securing of electric light wires is a simple matter, and the man to do it should be always at hand.

To facilitate such work, or rather, to make it unnecessary, it would be easy for the electric lighting companies to provide at suitable intervals, for the use of firemen, properly guarded switches or other means for cutting out from any fire threatened block any electric currents which might be liable to trouble or imperil the firemen.

Better still would be a law requiring all electric light conductors to be securely boxed or buried, so as to be out of the way of possible contact with telegraph or telephone wires. The street mains might be placed against or under the curbstones or beneath the sidewalk, and under the pavement at street crossings. This at one stroke would eliminate the graver perils incident to the present method of running the lines through the air.

With the rapid extension of electric lighting by means of arc lights, the hazard of life and property arising from misdirected currents has suddenly become one of the most serious as well as alarming of city evils. And it is certain that were the community to fully realize the subtlety, pervasiveness, and indeterminableness of the perils arising from vagrant electricity, as it would if each diversion of an electric light current were accompanied, as the not more dangerous lightning stroke is, by a peal of thunder, there would arise a speedy and positive demand for the adoption of safer modes of distributing this useful but treacherous agent. One thing is evident: the present mode of suspending electric light wires will not answer. And the sooner the electric lighting companies adopt a better method the better it will be for them, as well as for the public at large, for every day's extension of the present system increases the cost of displacing it; and its ultimate displacement is inevitable.

TESTING AND IMPROVING CAST IRON.

It is well known that ordinary cast iron, such as is used in the production of the stationary and moving parts of machinery, is of a granulated texture, the grains being so much separated as to present a mottled or honeycomb appearance, even to the naked eye, and when cut by the planer, chisel, or the lathe tool showing a dark gray surface. When this surface is filed, so as to reduce its irregularities, the color is brighter and the apparent dark interstices between the grains are reduced. But these reductions are only apparent; for if the finish of the surface is carried farther, so as to give a nearly uniformly bright color, and then lightly treated with an acid, as sulphuric or nitric, or a mixture of both, the granular form will be manifested more strongly than when the iron was simply planed or turned. Indeed, the softer portions, which fill the pores between the real iron grains, will be eaten out by the acid, leaving plainly observed protuberances, which consist of the granules of the iron. So distinct is the difference, not only between the iron granules and their envelope, but also between the size of the granules, that a very slight magnifying power will show it.

Under the glass the surface of a smoothed and acid washed piece of cast iron represents very nearly that of an emery wheel, the particles of emery (iron) being more or less embedded in the surrounding material, some showing more and some less of their bulk.

If the spaces between the iron granules could be reduced, it is evident that the entire mass would be stronger; for they are usually filled with material that is of no value except as a means of cohering the particles of iron. And not only would the mass be stronger, but it could be worked with more economy of time and tools; for flint and sand are deadly enemies to a tempered steel edge. And not only would the mass be stronger and be worked at less expense, but it would present a far more attractive appearance when finished, whether that finish was for ornament only, for use and wear, or for painting.

From these remarks it appears that a method that could remove a part of the extraneous material that usually envelopes the grains of iron in a casting would improve the character of the iron; for in an iron casting it is the iron we seek, and not non-metallic and foreign material. In the foundry the prevention and removal of extraneous matter is partially provided for by careful skimming of the surface of the melted iron in the ladles, and by a rise gate in the flask, the latter giving an opportunity for a partial removal of the scum that escapes the skimmer.

But there should be a far more radical means of improving the quality of cast iron; and experiments are now being made in one of the most prominent establishments in the country, to produce a satisfactory result in this direction. The experiments consist mainly of trials of mixtures of different iron, in varying proportions in the cupola. And the first step in this direction is the procurement of pig from different ores, and subjecting it to a series of tests by surface polishing, etching, and examination under the glass, and also by examining the fracture of a breakage. The different grades of iron are then selected and tested in the cupola, and again by examination of finished surface. So far successful have these experiments been that mixtures of irons have been determined upon for different products, and it is expected that the trials will ultimately result in the production of an iron that shall work much easier than that now in use, shall be stronger, shall present a much finer surface, and shall require less fuel and time in melting in the cupola.

The establishment to which reference has been made has already adopted some of the suggestions indicated by the results of these experiments, and if the cost of their castings has not been reduced as they come from the foundry, the expense of preparing them for use by means of planer, lathe, drill, and other tools has been considerably lessened, while the ultimate product is vastly better than formerly. A single statement will convey an idea of the decreased cost of working a casting of this selected iron.

The same planer cutter used under exactly the same circumstances dressed an area fourteen times greater, without the necessity of being reground, than it did of the best ordinarily used iron. More definite information will be given when the experiments now in progress have been completed.

Cheese in Central New York.

The principal markets of the dairy region of New York are Utica and Little Falls. At the last meeting of the Utica Dairymen's Board of Trade for the season just closed, the Secretary, Mr. B. D. Gilbert, presented a report of the year's work. The season lasted from May to December. The cheese sold at Utica was 13,230,120 pounds; at Little Falls, 12,790,500. The average price was 11½ cents a pound.

The cheese industry, as represented by these two, the principal markets of the dairy region of New York, brought its patrons in seven months of 1882, $2,992,430.25. The total receipts in these two markets last year were $3,268,950; in 1880, $3,800,436. The falling off this year is attributed to the late opening, the cold spring, and dry summer.

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MORE WORK FOR INVENTORS.

It would fill a large volume to give even a brief mention of the various ways in which inventors have earned the title of public benefactors. What they have done in the way of life saving inventions alone entitles them to the gratitude of the human race. The misery and suffering that have been prevented by these men of brains is beyond calculation, and all mankind are looking to them for a continuance of their labors. An inviting field of labor is to promote safety to railway travelers and operatives. Notwithstanding the fact that recent improvements have made travel by rail one of the safest means of transportation, the loss of life and limb—not to mention property—on railways is something serious, and it remains for inventors to diminish the number of railway disasters as far as possible.

The *Railway Gazette* reports: "Killed in the year ending with October, 1881, 397; injured, 1,687. Year ending October, 1882, killed, 401; injured, 1,466." Some of these casualties were unavoidable, but many of them might have been prevented by the use of properly arranged safety appliances. Among the accidents reported for October last were six collisions from misplaced switches. It will be understood that safety switches will not prevent this class of accidents. A train takes a siding to let another train pass, and the switch is not changed. A train running in the same direction as the one side tracked must inevitably collide with the latter, if not stopped in time to prevent it. In such cases the only sure preventive would be an automatic signal connected with the switch in such a manner that the engineer of the coming train would be warned in time to prevent a collision. It is, by many, considered sufficient protection, where no safety switch is used, to signal trains that would run off the ends of the rails at a stub switch; that is, trains running in a direction opposite the way the frog points. A train running toward the point of a frog cannot derail on account of the position of the switch, as it must follow one track or the other, but the derailments occur to trains running toward the head of the switch. This is the kind of derailments the safety switches are designed to prevent, and where they are in use no signal is needed in that direction, but in the opposite one to *warn trains running toward the point of the frog.* Of course, the signal should be placed far enough from the switch to give time to control the train, and this signal would perform a double purpose, viz.: If the engineer desired to keep the main track, and the switch was turned to the siding, the gong (or other signal) would warn him to stop. If, on the contrary, he wished to go on the siding, he would know the switch to be right, and he could proceed "with caution." But here comes the need of another signal—to warn him in case there is a train already on the siding, and this, to be reliable, must also be automatic, and operated in some manner by the train occupying the siding. The aim in providing switch signals should be directed as much in the direction indicated by the point of the frog as in the direction pointed out from the "heel" to the "head" of the switch. Indeed, the former is of the greater importance, as some of the most horrible disasters on record have been caused by collisions resulting from misplaced switches which threw trains on the siding where other trains were standing. Trains running in the other direction over a misplaced switch (other than the safety switch) will be derailed, but such accidents are not usually as serious as the collisions. By providing the most approved safety switches, derailments of this nature will be prevented, and when we have proper signals, collisions from misplaced switches will be heard of no more.

Much destruction of life and property is caused by spreading of rails. Accidents from this cause are usually disastrous, for the reason that trains are usually running at a rapid rate, when spreading of rails is the cause of derailment. In classifying the causes of railway accidents, those assigned to this one may properly be charged to "defect of road," which in turn may be set down to defective management. It is not easy to determine the cause of rails spreading sufficiently to allow the wheels to leave them, without exhibiting signs of spreading long enough before an accident could happen to give ample time to make them secure There are various causes for the gradual widening of the gauge of the track, such as flange wear, yielding of spikes to lateral pressure in soft ties, an insufficient number of ties and spikes, rails out of surface, etc. These combine to spread the track gradually, but it must be the worst type of mismanagement that would fail to see and remedy this in time to prevent disaster. It requires a spread of 3½ inches to allow wheels to drop between the rails; and although old tracks are always more or less wide of the true gauge, for reasons stated above, it seems out of keeping with the present system of railway management to allow a track to spread enough to cause mischief. But inasmuch as the facts are before us, a remedy must be sought for, which it seems can only be found in some improved method of rail fastening. It is clear that if the ordinary ties and spikes will not hold the rails securely, some other means of fastening must be resorted to, and it belongs to inventors to provide the means. That we allow track to spread is not to our credit as engineers, mechanics, or railway managers. In October last, six cases of spreading of rails are reported, which killed one conductor, and injured three other train men, and damaged rolling stock to the extent of many thousands of dollars A moderate expenditure for improved rail fastenings would have prevented all this and much that has gone before.

The same month shows up twelve accidents from cattle on track. It may not seem clear how inventors could have reduced the number of accidents from this cause; but it is possible to largely diminish accidents from this cause. The following is a summary of the *Railroad Gazette* report of October accidents from cattle on track:

On the Rio Grande and Pecos Valley road, a construction train ran over a cow, throwing five cars from the track.

A passenger train on the Mont Alto road, Pa., ran over a cow; one car was upset; injuring nine passengers, four of them seriously.

A passenger train on the Midland North Carolina road ran over a cow, throwing off several cars and injuring a brakeman.

On the Chesapeake and Ohio road, a freight train ran into some cattle, throwing the engine and several cars down a bank. The engineer and fireman were killed.

On the Chicago, St. Louis, and New Orleans road, a freight train ran over a mule, and fourteen cars were piled up in a bad wreck, and a brakeman was killed.

On the Indianapolis and St. Louis road, a passenger train ran over a cow, throwing the engine and baggage car down a bank. The fireman was killed.

On the Louisville and Nashville road, a passenger train ran into some cattle, throwing the whole train from the track, killing the fireman and injuring eight passengers.

A passenger train on the Texas and Pacific road ran over a cow, throwing the engine down a bank and into a creek. A brakeman was killed and the fireman hurt.

A construction train on the Denver and South Park road ran over a cow and was thrown from the track and down a high bank, killing the conductor and two laborers.

A passenger train on the Missouri Pacific road ran over a cow, throwing the whole train from the track and killing a brakeman.

A freight train on the Louisville and Nashville road ran over some cattle, throwing the whole train off and killing the engineer and a brakeman. [This makes two accidents for that road in October.]

A passenger train on the Wilmington and Weldon road ran over a cow, and the engine and two cars were thrown from the track.

The above statement is summarized here to give inventors an idea of the value of an invention that will prevent such disasters. It is not expected that *all* such accidents can be prevented, but it is believed that much good would result from well-directed labor in this direction.

With poor fences, or no fences at all, cattle will trespass, and this is something that human ingenuity cannot prevent, but it would seem that more efficient cattle guards might be contrived which would prevent stock leaving the highways and trespassing on the railways, as they frequently do. Improved cattle guards would contribute somewhat to safety, but the pilot or "cow-catcher" is the objective point of inventors. It is morally certain that stock will get in front of the locomotive, and, unless such obstructions are met under the most favorable circumstances, great damage is done. The pilots on most locomotives allow animals to roll under the wheels instead of throwing them to one side. Of course, it is necessary to have a certain amount of clearance below the pilots, but many of them are much higher than is necessary to clear frogs and crossing planks or whatever comes above the surface of the rails. The "noses" of most pilots point too much skyward for the successful removal of animals from the track, and what is wanted is a "cow-catcher" that will not *run over* animals, but cast them to one side. Some wheel fenders should also be provided for the truck wheels, so that in case the pilot fails to perform its duty the wheels will encounter no obstacles, either animals or other obstructions. In these days of train-wrecking the pilot has responsibilities aside from removing animals from the track, and it is sadly in need of the earnest attention of inventors.

The amount paid annually by railroad companies for stock killed without doing damage to railway property is counted by hundreds of thousands of dollars, much of which may be saved by more efficient cattle guards. And it will be seen from the foregoing statement that the cost of life and limb, together with the destruction of property annually from "cattle on the track" is enormous, and a fortune is in store for those who will do the needful in the premises.

SAWING HARD STEEL WITH SAND.

The practice of mechanics is largely a series of experiments, some successive and cumulative and others isolated and independent. Some months ago a mechanic wished to cut some very narrow slots in a bar of steel that was hammer-hardened, and it was desirable that it should not be annealed and rehardened, because of the danger of disturbing the relative widths of the slots. The workman tried the ordinary saw, or thin rotary milling tool, but found it to be impossible to keep an edge. After many ineffective trials, he recollected having witnessed the sawing of stone with sand urged by sheet iron blades. He substituted a soft iron disk for his steel saw, and, procuring some moulding sand, he had the satisfaction of seeing progress made in the obdurate steel. By changing the moulding sand for fine quartz sand and using a disk of Muntz sheathing metal, feeding the sand with water, he performed the job in a most satisfactory manner.

Since that time he has experimented with disks of lead and antimony, of copper, plate brass (rolled), sheet iron, and the Muntz metal. He gives the preference to the latter, and has succeeded, by using three thicknesses of the metal, to cut a wide "kerf," in slotting more than one-quarter of an inch wide. In a width of these dimensions he prefers to score the edge of the disk so that one portion of the cut will be recessed while the other is advanced. The speed must be necessarily moderate—about that of turning iron in the lathe—or the sand and water would be thrown out of the cut before they could do their work.

The quality of the work varies, of course, with that of the cutting material employed, emery and oil not being used advantageously because of their cutting the saw faster than they do the more obdurate material. Quartz sand of various degrees of fineness appears to give the best results, and it seems to be necessary that the disk should be softer than the material to be cut. It is understood, of course, that the disks are not serrated like a circular saw, but are smooth on the edge. Indeed, their action appears to be precisely like that of the toothless blades used in sawing blocks of marble and other stones; they merely push the cutting sand against the material, or perhaps to a certain extent receive and temporarily hold it embedded in their softer material.

Cheapened Aluminum.

The improved process of producing the metal aluminum, recently reported from England, does not cheapen the product anywhere near enough to bring the metal into serious competition with iron. The inventor, Mr. James Webster, of Hollywood, near Birmingham, Eng., claims, however, to have found a way to solder and weld the metal. If this claim is true, and the methods are practicable, the improvement is likely to greatly extend the usefulness of the "coming" metal.

Mr. Webster's process of reducing the metal is described as follows:

A given quantity of alum and pitch, which are first finely ground, are mixed together and placed in a calcining furnace, by which means 38 per cent of water is driven out, leaving the sulphur, potash, and alumina with oxide of iron. The calcined mixture is then put into vertical retorts, and steam and air are forced through, which leaves a residue of potash and alumina only. This residue is afterward placed in a vat filled with warm water, which is heated with steam. The potash is thus leached out, and the alumina left as a deposit. The potash liquor is then run off, boiled down, while the alumina precipitate is collected in sacks and dried. It is then ready for making chloride of aluminum. The alumina deposit thus obtained contains about 84 per cent of pure alumina, while that which is obtained by the old process of precipitation has only 65 per cent. Mr. Jones, the Wolverhampton borough analyst, certifies that the constituents of Mr. Webster's alumina deposit are as follows: Alumina, 84·10; sulphate of zinc, 2·68; silica, 7·40; water, 4·20; alkaline salts, 1·62. In order to complete the process and convert it into aluminum, the chloride of aluminum is treated with sodium, in order to withdraw the metal. Aluminum is afterward alloyed with copper, silver, and other metals. It is used for the manufacture of bismuth bronze, aluminum bronze, or any other alloys.

Inventions and Inventors.

At a recent meeting of the members of the London Association of Foremen, Engineers, and Draughtsmen, Mr. E. G. Swann read a paper entitled "Inventions and Inventors." He said that inventions had either been accidental or elaborated by study and research. The invention of gunpowder, printing, and mechanism were the results of study and research. All inventors had been benefactors of the world in their respective degrees. The patent laws had long been a subject of discussion, but the question was, Would it not be better, after all, to abolish the patent laws altogether, and to secure the rights of inventors by simple registration of first publication, in the same way as the rights of authors, artists, and designers were secured? Assuming that the patent laws were to be preserved or continued, he suggested that, in anticipation of international patent laws, they should adopt the seventeen years' term in force in the United States. Then the full term should be divided into five subterms: the first of five years, on a payment of £10, and the other four of three years each, on a payment of £5, making in all £30, and a month's grace, subject to a fine of £1, to be allowed in each sub-interim. He would have no examination into the novelty of the patent, and he would have all patents classified, condensed, and indexed up to within six months, and announced in a weekly illustrated journal to be filed in every town, either in the public library or principal post-office. All fees should be paid in adhesive stamps, to be canceled only at the Patent Office; and all assignments to be void unless registered at the Patent Office, which could be done on the payment of a fee of 10s., and the register to be open for inspection on the payment of 1s. as a stamp fee. He would have all Patent Office employés to hold office during good behavior. The government should pay a royalty for the use of any patented invention; and, finally, all disputed questions about patents to be decided by a special tribunal for the special purpose. He believed that in the present day nine inventions out of ten turned upon mechanical contrivances. He proceeded to say that science itself had borrowed its resources and arrived at the precise disclosure of facts to solve obscure problems from mechanical appliances, until at length some points were reached at which all branches of knowledge and all varieties of skill became naturally reflective, auxiliary, and accelerating.

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Oil Refining.

The apparatus employed for separating the various ingredients contained in crude petroleum in the process of obtaining kerosene consists of an iron still having a wrought iron worm pipe, which is submerged in a tank containing cold water. The still having been filled with crude oil, a fire lighted beneath it causes the oil to boil and drives off the more volatile vapors, which at ordinary temperatures pass over without being condensed. By surrounding the coil with ice, or by compressing these gases by means of an air pump, they may be condensed into the form of very volatile liquids, termed rhigolene and chymogene.

After these have been eliminated, the vapors begin to condense in the coil, the resulting oil being received in a tank at its farther end. That first formed has a gravity of 95° Baume, but the product becomes heavier as the process proceeds. It is usually customary to direct the stream into one tank until the gravity reaches from 65° to 59° B., forming crude naphtha, when it is diverted into the kerosene tank, into which it is allowed to flow until a gravity of about 38° B. is reached, or the oil becomes of a yellow color. This second fraction is the burning-oil, which requires a farther purification to fit it for use. The stream is next directed into the paraffine oil tanks, and allowed to run until nothing remains in the still except coke. When, however, very large stills of 1,000 barrels capacity or upward are employed, the distillation is stopped when the residuum has attained a tarry consistence, the remaining oil being extracted in smaller stills.

By slow distillation in high stills, the production of the heavier oils may be avoided, they being "cracked" into lighter oils, so that only crude naphtha, kerosene, and coke result.

The burning-oil is purified by the addition of about ten per cent of sulphuric acid to improve the color and deodorize it. The acid is poured into the oil and the liquid thoroughly agitated and then allowed to stand, when a dark tarry residuum separates. This is removed, and the clear oil is then agitated with water and afterward with caustic soda or ammonia. This neutralizes any remaining traces of acid, and is removed by water. In some instances it is then heated to expel a small proportion of naphtha or benzine which it may contain, or is redistilled.

The crude naphtha is redistilled for gasoline, benzine, or refined naphtha, or is poured into the oil wells, nominally for the purpose of cleaning them. In some instances it is used for adulterating the crude oil sold to the refiner.

In the details of the process of refining, manufacturers somewhat differ. Some blow steam through the crude oil, thus taking off the naphtha previous to distillation. In other instances, the heavier portions of the distillate are separated, forming safer oils than those in ordinary use. Thus, "astral oil," averaging 49° B., flashes at 125° of Fahrenheit's scale, and "mineral sperm," having a gravity of 36° B., only yields inflammable vapor at temperatures above 262°.

Oil which flashes at or above 100° F., is considered safe for ordinary use, but the temptation to allow the heavier portion of the crude naphtha, an article which commands a much lower price than oil, to flow into the tank designed for the latter is so great that many kinds of oil in the market are very dangerous, their vapors exploding at a much lower point.

Instead of continuing the flow of naphtha into its proper tank until a gravity of 58° or 59° B., is attained, it is diverted into the burning-oil reservoir while yet as light as 63° to 65°.

Dr. White, of New Orleans, found that one per cent of naphtha added to an oil which flashed 133° F. caused it to flash at 103°; with 2 per cent added it flashed at 92°; with 5 per cent at 83°; with 10 per cent at 59°; and with 20 per cent at 40°.

Ordinary kerosene, having a gravity of 47° B., flashes at 86° F. An oil which will not flash below 100° may be made by running off the naphtha to 58° B., and exposing the oil in shallow tanks to the sun or a strong light for a day or two.

The average yield of crude Pennsylvania oil is stated to be: Gasoline 1½, refined naphtha 10, benzine 4, refined petroleum or kerosene 55, lubricating oil 17½, paraffine 2, loss, gas and coke, 10, total 100.

By "cracking" it can be made to yield: Crude naphtha 20, burning-oil 66, coke and loss 14.

The method for ascertaining the degree of heat at which the hydrocarbon vapors of petroleum are liable to explode consists in heating the oil in a porcelain vessel surrounded by a hot water bath. A wire is placed a quarter of an inch above the rim of the vessel, and when a thermometer whose bulb is submerged 1½ inches below the surface of the oil indicates the desired heat, say 90°, a small flame is quickly passed along the wire over the surface of the oil; if no flash is produced, the heat is continued and the test applied at every 3° above this until the flashing point is reached. The operation is then repeated with a fresh sample of oil, fresh water being used in the outer vessel, the source of heat being removed when a temperature approaching that obtained in the first experiment has been reached. This is the English method, but there are other ways of testing petroleum employed in this country, which are, however, similar in principle, and nearly so in detail, to that described above.—*Glassware Reporter.*

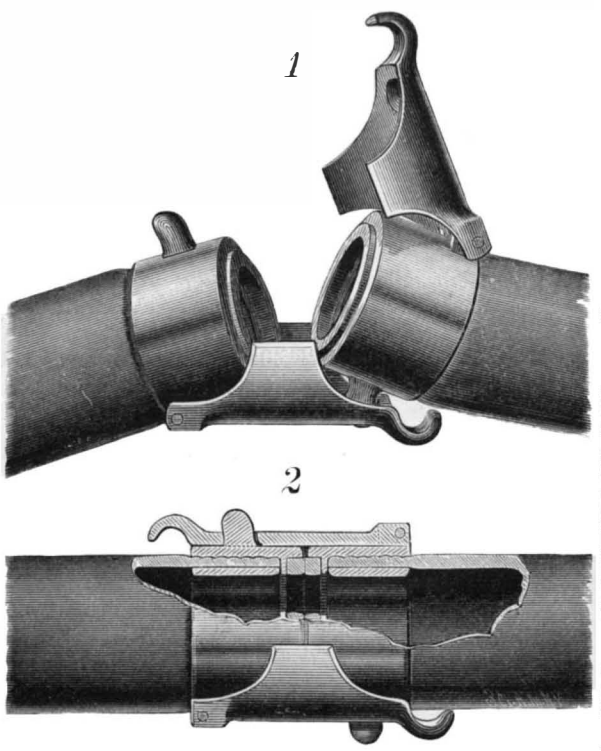
THE Madrid Mining and Metallurgical Exhibition is announced to open in the Park of Madrid on April 1, 1883.

Estimation of Tannin.

G. Simand has been experimenting on Lowenthal's method of estimating tanning by glue or gelatine, in the Vienna Laboratory of the experiment station for the leather industry. As he could not obtain concordant results within it, he had recourse to the use of hide or tissues that contain glue. His experiments are described in *Dingler's Journal* (cxlvi., 133). Unoiled violin strings were used by A. Girard with still better results. The commercial tannic acid contains variable quantities of tannin, and hence cannot be used in these comparative experiments.

NEW HOSE COUPLING.

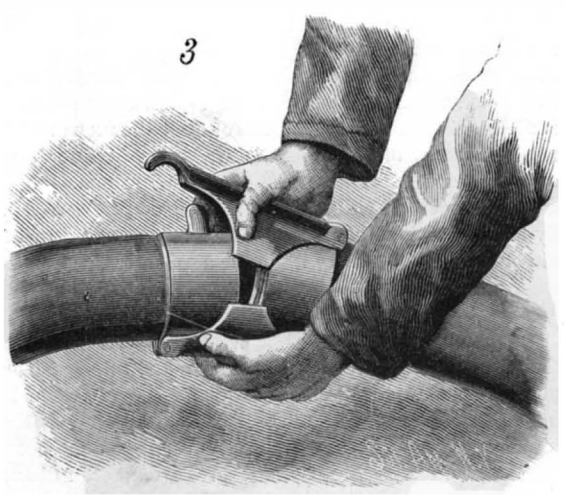
The difficulties attending the use of the old fashioned hose coupling are too well known to require mention here. The time consumed in effecting a union of the lengths of hose,



CASSEDY'S HOSE COUPLING.

the necessity of having the right ends together, the use of a spanner, and the great liability to injury are all serious objections to the common form of coupling, which are obviated by the invention illustrated by the annexed engravings, in which Fig. 1 shows the coupling partly united. Fig. 2 shows it united, and partly broken away to exhibit the packing rings, etc. Fig. 3 shows the manner of coupling.

The two halves of the coupling are exactly alike, so that it makes no difference how the ends of the hose sections are arranged. Each half of the coupling has a latch hinged to it, which partly encircles it, and is apertured near its free end to fit over a beveled rib on the other half of the coupling. In the face of each half coupling there is an annular space for the packing ring, which makes the joint tight.



CASSEDY'S HOSE COUPLING.

This coupling is adapted to steam as well as water pipes where a temporary connection is required. It has been tested at a pressure of 225 pounds per square inch, and is steam, air, and water tight. One person can connect and disconnect it without the use of tools of any description. It can even be done readily in the dark, and requires only an instant to couple or uncouple it. There is no possibility of its flying apart. A complete coupling for a 2½-inch hose weighs only 5 pounds.

Hon. W. B. Miller, 160 West State street, Trenton, N. J., is agent for this coupling. Messrs. Williams & Cassedy, of Cape May City, N. J., are proprietors.

Tests for Light.

Dr. Koenig has been making a number of experiments on the quality of different kinds of light by means of the leucoscope, an instrument of his invention. It consists of a rhomboid of calcspar, a quartz plate, and a Nicol's prism. When a ray of light enters the spar it is split into two rays, polarized at right angles. These traverse the quartz and Nicol. When analyzed they show two spectra of absorption bands. and the peculiarity is that where the bands occur in one, the other spectrum is of pristine brightness, so that the two spectra overlaid give a continuous spectrum. The number of bands is increased by increasing the thickness of quartz, and they can be shifted by rotating the Nicol. It is possible, therefore, by rotating the Nicol, to make the colors in each spectrum produce white light together. When different kinds of light are examined by the instrument, different amounts of rotation of the Nicol are required to bring the two spectra into conformity, and the angles of rotation are a gauge of the color-quality of the light examined. According to results communicated to the Physical Society of Berlin, Dr. Koenig finds that the angle for stearin candles is 71·20 deg., for gaslight 71·5 deg., for electric arc light 79 deg., for magnesium light 86 deg., and for sunlight 90·5 deg. For burning phosphorus and the Drummond lime light the angles were between gas and the electric light. It thus appears that the magnesium light more closely resembles sunlight than that of the electric arc, a result confirmed by the fact that the aniline dyes, hardly distinguishable by gaslight, can all be distinguished by the arc light, except a few "bronzes," and even these are clearly distinguishable by magnesium as by sunlight. Dr. Koenig has also tested Swan and Edison incandescence lamps, and finds that the luminosity increases at first in a much greater rate than the current increases; doubling the strength of current very largely increased the luminosity. The highest angle reached was 78, or very nearly that for the arc lamp. These researches are of much interest. They indicate the excellence of magnesium as a standard light giver.

Action of Poisons on the Petals of Flowers.

A. Anthony Nesbit, F.C.S., states in the *Journal of Science* that he has made some experiments on the action of various substances on the life of flowers, and for this purpose selected some of the best known alkaloids, viz., strychnine, solanine, digitaline, quinidine, atropine, quinine, cinchonine, picrotoxine, aconitine, brucine, and morphine, using one-quarter per cent and one per cent solutions. The alkaloid of tobacco being very difficult to obtain pure, owing to its rapid oxidation, 5 per cent and 20 per cent solutions of tobacco (bird's eye) were used in its stead. The flower chosen for experiment was the narcissus, and the results showed that there was here a wide field for long and patient investigation.

Of all the twelve solutions, tobacco proved, in a very marked manner, to be most destructive to the life of the flower of the narcissus; the remaining eleven poisons, though but slowly injurious, nevertheless in some instances showed marked difference of effect, or, it may be said, symptom. Thus strychnine, next in poisonous power to tobacco, drew the petals upward, and made them dry and brittle, symptoms also exhibited by solanine poisoning, while quinidine and several other alkaloids rendered the petals limp and rotten. Morphine, one of the least poisonous (to the narcissus) of the alkaloids experimented with, without destroying the flower, curiously enough imparted to the petals a flaccidity resembling that of the petals of the poppy.

A Gasoline Engine.

A petroleum motor, or rather an engine for obtaining motive power from an explosive mixture of gasoline vapor and air, has been constructed by a Hanoverian firm, and is described by Professor Schottler in the *Wochenschrift des Vereins Deutscher Ingenieure.* The working cylinder is 8 inches in diameter, with 14 3/16-inch stroke. The design of the machine is similar to that of a type of gas-engine constructed by Wittig and Hees. The gasoline is led through pipes to the pump cylinder, where it mixes with a definite proportion of atmospheric air. The mixture is then compressed and forced into the working cylinder, where it is ignited by a lamp separately supplied with oil. In four trials with the particular engine in question, the maximum force obtained was 4·5 horse power, with 130 revolutions per minute. The consumption of spirit of sp. gr. 0·675, was at the rate of 1¾ to 2½ pints per horse power per hour. The value of the material is estimated at 1⅝d. per pound weight; and the machine is stated to require as little attention and to work as cheaply as a gas engine.

Silico Copper Electric Wire.

Owing to its greater strength phosphorus bronze is used sometimes instead of copper for conducting electricity, since much smaller wire possesses the necessary strength. The resistance offered by phosphorus bronze is considerably greater than that of copper, so that while it answers well for telephone wire it is not adapted to long telegraphic lines. L. Weiller, of Angoulême, has recently alloyed copper with silicon instead of phosphorus, and made a silicon bronze, the conductivity of which is twice that of phosphorus bronze, while its strength is not less, and hence seems well adapted to electric conductors. The relative strengths of copper, silico bronze, and phosphorus bronze are as 28, 70, and 90; conductivity as 100, 61, and 30.

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Fireproof Paint.

Various substances have often been proposed as fireproof coatings for the protection of woods employed for building purposes, but most of them have been abandoned as being either too costly or not sufficiently durable. The following process, invented by Messrs. Vildé and Schambeck, is described in *La Papeterie*. The paint consists of 20 parts of finely pulverized glass, 20 parts of finely pulverized porcelain, 20 parts of any sort of stone in powder, 10 parts of calcined lime, and 30 parts of water-glass (silicate of soda), such as usually found in commerce. The solid elements having been powdered as finely as possible and sifted, are moistened, and then intimately mixed with the water-glass. This yields a mass of sirupy consistence that may be employed for painting, either alone or mixed with color. The addition of the lime gives a certain unctuosity to the mass for whitewashing, and its combination with the silicic acid of the soluble glass serves to bind the other materials together. The proportion of the different elements above mentioned may be changed save that of the water-glass, which must remain constant. These elements may even be replaced one by another; but it is always well to preserve the lime. Instead of the silicate of soda (soluble glass of soda), soluble glass of potash might be used; but the former is less expensive. The coating is applied with a brush, as other paints are, as uniformly as possible over the surface to be protected. The first coat hardens immediately, and a second one may be applied six hours or more afterward. Two coats are sufficient. This paint may likewise be employed as a preservative against rust, and used as a coating for iron bridges, etc.

LOG SETTING APPARATUS FOR SAWMILLS.

The engraving shows an apparatus by which the sawyer is enabled to gear the log shifting devices of the carriage with a shaft located alongside of the carriage, so as to shift the carriage farward or backward at will.

The carriage ways or tracks, head block, sliding knees, racks, the adjusting shaft, and pinions are of the ordinary construction.

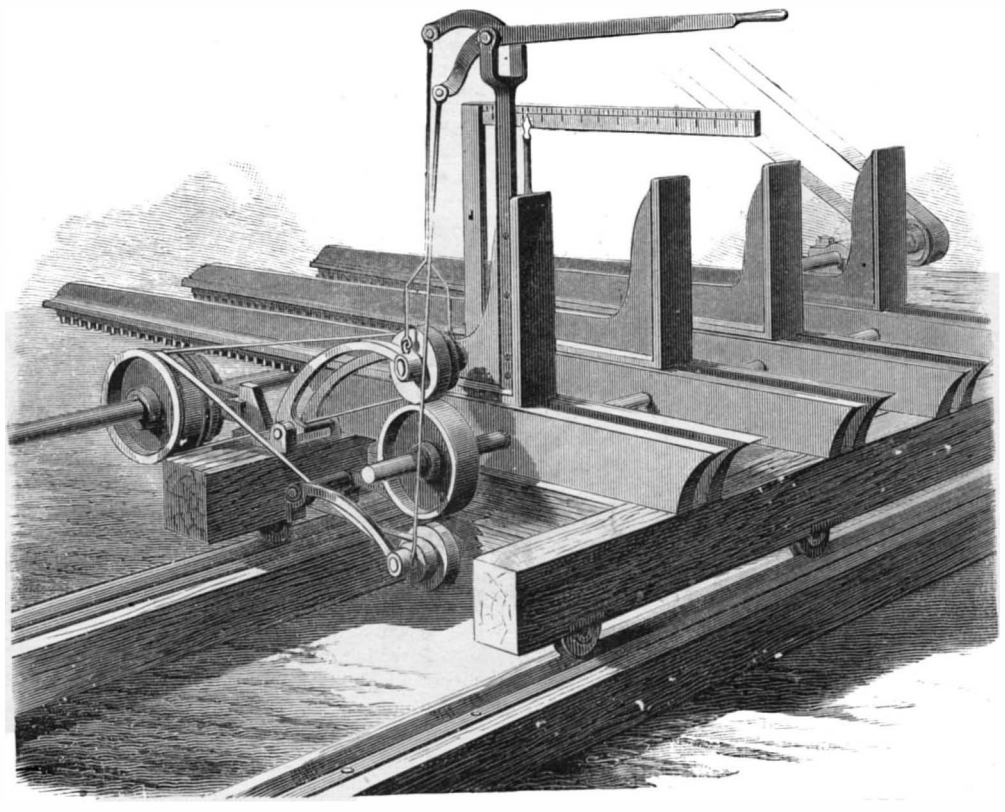
To turn the adjusting shaft and pinions by power at the will of the sawyer, for setting the log up to the saw from time to time, and for shifting the knees back when a new log is to be put on, there is arranged a long shaft at the side of the carriage, at the back. This shaft is revolved continuously by a belt from any suitable driving pulley. On this shaft there is a double pulley arranged so as to slide along it as the carriage goes, the pulley having a feather running in the groove of the shaft, so that it may revolve with the shaft so as to drive the friction pulleys journaled in the swinging frames above and below a pulley on the log adjusting shaft. The upper pulley is driven by a straight belt, the lower one by a crossed belt for reversing the motion.

The pivoted frames carrying the friction wheels are suspended from the hand lever at the top of the first knee rods, so that by shifting the lever in one direction one of the friction wheels will be made to drive a wheel on the adjusting shaft in one direction, and by shifting it in the other direction the other wheel will drive it the other way, while in the middle position both wheels will be disconnected and the wheel on the log adjusting shaft will be inoperative.

A scale is so located with reference to a pointer on the first knee as to gauge the movements of the knees.

With apparatus of this kind the setting of the logs is greatly simplified, and at the same time it may be done accurately and quickly.

This invention has been patented by Mr. Walter P. Schofield, of Cedar Keys, Fla. Further information may be obtained by addressing Messrs. Schofield & Bailey, at the same place.



SCHOFIELD'S LOG SETTING APPARATUS FOR SAW MILLS.

Manufacture of Aluminum.

The English patent of James Morris is as follows: Powdered charcoal and lampblack are mixed with a strong solution of chloride of aluminum and dried by heat to a stiff mass. When the heat has expelled the HCl, they are formed into pellets. These pellets, consisting of 5 of carbon to 4 by weight of alumina, with a little water, are placed in a retort and heated, while for fifty hours a current of carbonic acid is passed through. Carbonic oxide is formed, and while in the nascent condition takes oxygen from the alumina till the carbon is mostly consumed and a sponge of aluminum is left. This is then melted in a crucible with cryolite.

The Anthracite Product of Pennsylvania.

The past year's output of the anthracite coal mines of Pennsylvania was the largest on record. It was, in round numbers, 29,500,000 tons, or nearly 1,000,000 tons more than in 1881.

IMPROVED VISE.

We give engravings of a vise which is novel both in form and in the principle upon which it operates. Only two styles are shown, one being a hand vise, the other a brace wrench. In addition to these, vises on the same general principle are made in larger sizes for bench work, for smiths, and for all other purposes where a substantial and reliable vise is required. It not only acts as a parallel vise, but it has greater gripping power than vises of the usual form, and is much more powerful than the ordinary parallel vise.

All of the parts are of steel, drop forged, and finished by the most approved machinery, so that the pieces of any particular style of vise are interchangeable, admitting of renewing broken or worn parts if required.

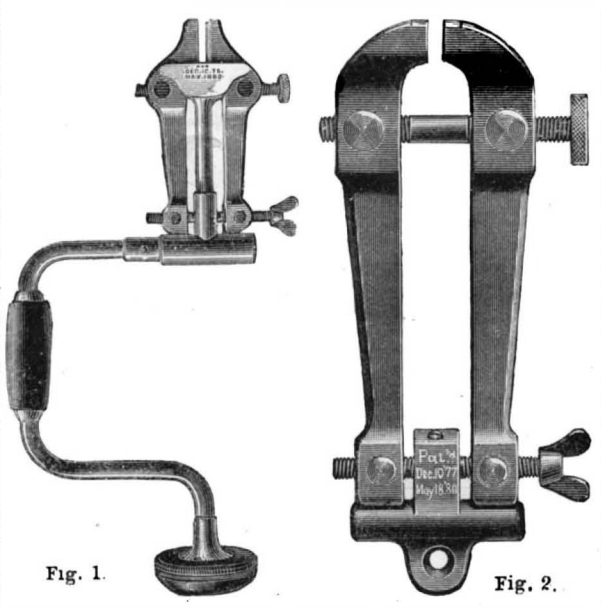


Fig. 1. Fig. 2.

COMPOUND POWER VISE.

Being made wholly of steel, these vises are not only lighter but stronger than iron vises.

The jaws are provided with two screws, each right-handed on one end and left-handed on the other, so that by turning the screws in one direction the jaws will be approached toward each other, and by turning them in the other direction the jaws will be separated. The nuts in which these screws work are cylindrical, and are capable of turning in their bearings in the jaws, so that the screws always have a direct bearing. The movement of the jaws is very quick, and by turning both screws alike, the jaws are kept parallel with each other. When the jaws are nearly approached to the object to be grasped, or in contact with it, the tightening or principal pressure is secured by turning the screw farthest from the jaws.

In its application to the brace, as shown in Fig. 1, the vise may be used to turn nuts and bolts, also drills, bits, and other tools.

The vise represented in Fig. 2 is designed to be used as an ordinary hand vise, or as a vise for line men in running telegraph, telephone, and electric light wires. Provision is made for a ring to receive a strap, and the small ends of the jaws slide in ways in the crosspiece, so that no strain is put upon the screw.

Further information in regard to this useful invention may be obtained by addressing Messrs. Cook & McLane, 81 Centre Street, New York City.

Surgical Instruction for Engineers.

It is pretty generally recognized among surgeons that the successful practitioner of that art has need of not a little mechanical ability. Indeed, many if not most surgeons of eminence have shown a genius for mechanics of the finer sort, and have owed to their mechanical skill and dexterity no small portion of their professional success.

On the other hand, it is beginning to be understood that a limited knowledge of operative surgery, certainly enough of the art to enable a man to tie an artery, stanch a flow of blood, or bind up the wounds of an injured workman or traveler, is highly desirable, if not vitally necessary, to mechanics and engineers. This is especially true of the foremen of machine shops, engine drivers, and civil and mining engineers. In many manufacturing operations and in all works of constructive and mining engineering, accidents are always liable to happen; and not unfrequently the needed surgeon is miles away. In any case, the advantage of having close at hand some one familiar with the first treatment of serious hurts, who can do what is needful to be done in such emergencies to keep the patient's life from wasting before the regular surgeon's help can be obtained, is beyond question.

Hitherto, so far as we know, provision for this important line of instruction for young engineers and foremen in constructive works has never been made by our technical institutions. The trustees of the University of Pennsylvania, however, have now taken the first step in a movement in this direction, and have engaged a lecturer on operative surgery to give a course of lectures on surgery to the senior scientific classes of the collegiate department of the University, especially the mining and engineering sections. The innovation is a good one, and it is to be hoped that the results will be so encouraging that the lectures will be not only continued, but imitated in all high grade technical schools.

Progress in Florida Drainage and Exploration.

A press dispatch states that the dredge of the Okeechobee Drainage Company, working up the Caloosahatchee River, entered Lake Okeechobee December 25, thus completing a navigable channel from the Gulf of Mexico to the heart of the Everglades. The canal is also expected to be an important factor in the draining of large areas of rich sugar land about Lake Okeechobee.

Though Florida was the first settled of all the Atlantic States, the great swamp country of the Everglades remains one of the least known regions of the globe. The first party of white men known to have crossed that part of the State completed their venturesome trip December 14. It was an exploring party sent out by the New Orleans *Times-Democrat*, with two boats. Their route was from Kissimmee City, across Lakes Tohopekaliga, Cypress, Hachewaha, and Kissimmee; down the Kissimmee River to Lake Okeechobee (exploring Lake Okeechobee on the eastern and western shores); across the lake to the entrance to the canal of the Atlantic, Gulf Coast, and Okeechobee Land Company, at which point their boats were hauled to the dredge boat in the canal, down the canal to Lake Hickpochee; through Lakes Hickpochee, Lettuce, and Flirt to the Caloosahatchee River, and down the river to Fort Myers, a distance of about 500 miles. The explorers say that the garden spot of Florida is there in the unsettled interior.

American Ochre.

In a communication to the Tariff Commission, Mr. Junius Gridley, Secretary Bermuda Ochre Co., of this city, states that until the year 1871 no ochres were found in the United States that could successfully compete with the ochres imported from France, in point of color and other characteristics. Common ochres, however, were abundant and largely mined, especially in Vermont and Pennsylvania, which are extensively used by oil-cloth manufacturers for a filler in the body of the cloth where the color or tint is of no account.

In 1872, a deposit of ochre equal in quality to the French product was discovered on the Appomatox River, at Bermuda, Va. From this deposit are now taken 1,000 tons a year, or about one-third the fine ochres used in the United States. The Virginia deposit contains about 10 per cent of sand or grit, which has to be washed out before the ochre can be ground and bolted. The French (Rochelle) ochres are so pure that they may be mixed and ground without washing. They are shipped as ballast freight for much less than the cost of transporting the Virginia ochre from City Point to New York by steamer. Since the Virginia deposit was opened the price of Rochelle ochre has fallen from 3¾ cents to 1¼ cents a pound, the effect, it is claimed, of the competition of the home product.

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THE GREAT DRY DOCKS AT THE ERIE BASIN.

(*Continued from first page.*)

and secured heavy transverse floor timbers of yellow pine, covered with spruce planking to form the floor, and carrying the keel blocks, the latter being additionally supported by four rows of piles firmly driven under the floor timbers and capped with heavy yellow pine timbers along the axis of the dock.

The heads of these piles along the keelway are also inclosed in a continuous bed of Portland cement concrete.

Open box drains are provided on each side of keelway beneath the floor timbers, leading to the drainage culverts at the head of each dock.

The sides and heads of the docks are built with a slope of about 45°; the alters to high water level are of yellow pine timber, nine inches rise and ten inches tread, and bolted to side brace timbers, which are supported by piles and abut upon the ends of the floor timbers.

The alters are carefully filled in behind with clay puddle, as the sides are built up, and from the level of high water to top of coping the sides are built of concrete *en masse*, faced with Hoope's artificial stone, the alters being continued of the same material to coping level.

The keel blocks are placed upon every floor timber, and bilge blocks of the usual form, sliding upon oak bearers, upon every other floor timber.

Lines of close sheet piling of tongued plank inclose the floor of the dock and also extend entirely around the dock outside of coping, and across the entrance of outer end of apron and at each abutment, forming cut-offs to exclude the tide water, etc.

An iron caisson or floating gate is used to close the dock, made with sloping ends corresponding substantially with the slope of side walls in the body of the dock, which bears against the sill and solid timber abutments the whole length of its keel and stem, "no grooves" being used.

Each dock has two gate sills and abutments, the outer one being provided chiefly to facilitate examination of and repairs to the inner or main one generally used.

The joint is made water-tight by means of a rubber gasket secured to face of sills and abutments.

The principal advantages which these docks possess over stone docks, as usually constructed, are greater accessibility, better facilities for shoring vessels, better distribution of light, and dryness.

The narrow alters and gently sloping sides afford safer and easier means of ingress and egress at every point, furnish a better supply of light and air, and the shoring is more easily adjusted, all of which materially aid in the dispatch and economy with which work of repairs can be prosecuted.

From facts gathered by the inspectors it appears that the life of timber docks is as yet unknown, though the substructure, which is kept constantly wet, can be said to be practically imperishable. Judging from all the information obtainable, the inspectors are of the opinion that the repairs of a timber dock of good quality, of good materials, and well built, would be insignificant for a period of say twenty years, when it would probably be found necessary to renew all woodwork above high water level, and the face timber above half tide level.

The relative average yearly cost of repairs of these docks as now constructed and the ordinary stone docks would, it is thought, be in favor of the timber docks, especially in latitudes much above the frost line.

The manner and cost of operating does not appear to differ materially from other kinds of well constructed excavated docks.

The dock is emptied by two Andrews centrifugal cataract pumps, each driven by a vertical engine, having twenty-four inches diameter of piston and twenty-four inches stroke.

These engines are ordinarily run at fifty revolutions per minute, and by spur gearing between the engines and the pumps the revolutions of the latter are double those of the former.

The dimensions of the pumps were given to us as seven feet in diameter and three feet in width, and the effective capacity of each as twenty-three thousand five hundred gallons per minute. The dock No. 1, at present in use, has, it is said, been emptied, while holding a ship of four thousand tons measurement, in one hour and eight minutes.

The Board is impressed with the efficiency of the caisson of the peculiar shape employed by Mr. Simpson; the sloping ends of the caisson and absence of grooves in the abutments permit the removal of the caisson and the opening and closing of the dock in the shortest time without difficulty and with the least handling of water ballast.

An underground steam pipe from the pumping engine boiler leads to the entrance, whence steam is conveyed to the pumps on board the caisson by flexible hose, and the expense and care of a boiler on the caisson thereby avoided.

Coke and its Products.

The great rise in the value of the products given off in the distillation of coal has, for a considerable time past, directed increased attention to the waste that attends the process of coke burning, and several attempts have been made to utilize the volatile hydrocarbons of the coal without deterioration to the quality of the coke. Recently Mr. John Jameson, of the firm of Jameson & Schaeffer, consulting engineers, Newcastle, has invented a new method of distillation, which is attracting great attention in the North. The process consists in the application of a very slight exhaustion in the floor of a coke oven, while the coking is going on in the usual way. The volatile products thus withdrawn are cooled in a range of pipes, so as to allow the condensable hydrocarbons and ammonia water to be deposited, while the incondensable gas is either used as a by product, or is passed into the lower part of an entirely ignited oven, where the carbon of its hydrocarbon is deposited in the pores of the coke, in the same way that carbon is deposited from a gaseous atmosphere on to the red-hot filament of an incandescent lamp. In the ordinary process of coke burning the ignition of the coal begins at the top of the oven and proceeds downward. Under the heat the coal softens and agglomeration of the particles takes place, accompanied by the evolution of gases and vapors, which find their way toward the surface, where the former are, for the most part, burned, and the latter decomposed and lost. As the process proceeds the stratum of agglomerated particles thickens, and as the heat increases the products separate, the more volatile forcing their way to the surface, and the less volatile becoming set in the charge and coked. Under the new process these conditions do not obtain. The vapors formed at the lowest possible heat pass at once into a colder stratum of coal, the raw coal being gradually warmed and its most volatile products caught away, while the least volatile may be left to enrich the coke. The yield of oil and ammonia varies with the quality of the coal, the quantity obtained from Sherburn coal being 6·8 gallons of oil per ton of coal, and a quantity of ammonia equal to 4 pounds to 6 pounds of ammonia sulphate. An analysis of the oil showed solid paraffin to the extent of 17 to 23 per cent. It is stated that the cost of application of the invention to a row of coke ovens need not exceed £20 per oven.

A Good Varnish.

Shellac in one of its many shapes forms in this case, as in most others, the foundation upon which the varnish is built; and, indeed, we may say at the outset that a plain solution of shellac makes one most excellent in quality. Shellac, under its various names indicative of its color, is really only another form of the so-called "seed lac," and also of stick lac, some recipes giving most absurd instructions as to the proportion of the various forms of resin to be used. Stick lac is simply the twig encrusted by the lac insect with the peculiar substance it produces. Seed lac is the incrustation removed, in which state it presents the appearance of small seed; and shellac is the purified seed lac, melted, strained, and placed on large cylinders or slabs to harden, from which the resin is chipped or shelled off as "shell-lac."

Shellac is found in commerce of an infinite variety of shades of brown from the pale "orange," as it is termed, to the deep garnet or ruby color, which is useless for our present purpose. Such shellac dissolved in spirit would give a solution that could not be decolorized in any practical manner—at any rate by the working photographer. For our purpose the very finest "pale orange" shellac procurable should be purchased; and when varnish is likely to be made in quantity, the samples must be first obtained so as to enable the stock to be purchased where the palest sample came from. Those who have not before paid any attention to the matter will be surprised to discover how varied in color even high priced shellac will be found. Another consideration, which will scarcely need to be pointed out in the selection of shellac, is to see that the pieces are as clean looking as possible. In this respect also great differences will be found.

A solution of such a shellac in methylated spirit forms the basis of our varnish, and a simple varnish so made will answer for all rough work; but where delicate results are wanted it must be paler in color, and for this purpose we use "bleached shellac."

Bleached shellac dissolved in spirit also makes an excellent varnish; but it is not nearly so hard and tenacious as that from the orange shellac. A good strong coating of it is readily scratched by the finger nail—a *contretemps* so likely to occur in printing that such a varnish cannot be recommended. White shellac is made by dissolving ordinary shellac in caustic alkali, and then treating the solution with chlorine, which at one and the same time decolorizes and precipitates it. This process, though it produces a pale resin, of great value for many economical purposes, causes the resin to lose many of those properties that specially fit orange lac for use in photographic varnish. One of the peculiarities of white lac varnish is the frequency with which it dries into a multitude of fine ridges, which no rocking of the plate to and fro during draining or drying will prevent. But for paleness of color in the coating obtained from it nothing can be better; and in a mixture of the two resins—that is, the bleached and the unbleached—the objectionable qualities of either seem either covered or greatly minimized. This mixture, in suitable proportions, constitutes the chief part of the varnish we recommend.

Experimenters with "bleached," or, as it is often called, "white lac," must know that unless it be properly stored it practically loses its solubility in spirit of wine; and we know of many cases of failure in varnish making caused through the purchaser being supplied with a sample that had become insoluble. Of course, this would not be likely to occur in a place where the lac was in great demand; but many of our readers live in places where photographic—indeed, any rare—chemicals are most difficult to get, and when obtainable are not always in good condition. However, in the case of white lac, where the experimenter is ignorant of the appearance it should present, he can easily test a small quantity if he have any doubt in the matter. It should be crushed or pounded into small pieces before adding to the spirit, as even in the best samples a large proportion entirely insoluble always exists, and a clear solution must not be expected. Its solubility or the reverse is soon discovered by noticing whether the small particles begin to disintegrate, as it were, or retain their sharp outlines.

A good indication of insolubility is the outer layer of the round pieces or sticks turning semi-transparent. The plan usually adopted to prevent this change taking place is to keep the bleached lac in the dark and covered with water, when, if it remained so covered, it will retain its solubility in spirit for a lengthened period.

The third and last ingredient in this varnish is "sandarac gum." It is well known by varnish makers that when gums and resins are mixed and "blended" in solution, the character of this solution or varnish is not by any means of necessity an average of the characters of the gums taken separately, and such is the case with sandarac. This gum, taken by itself, gives a varnish that is quite useless from its brittleness, but when added to a shellac varnish it confers a portion of its own quality of brightness of surface, which it possesses in a high degree, but does not, in moderate quantity, tend to make it "rotten."

The formula for a varnish devised on the principles above enunciated is as follows:

Palest orange shellac	2¾ ounces.
Bleached lac	5½ "
Gum sandarac	½ ounce.
Methylated spirit	1 quart.

Bruise the bleached lac till reduced to small pieces. Powder the sandarac, and then add the whole to the spirit, putting in a few small pieces of glass to prevent the shellac caking at the bottom of the jar; stir or well shake the whole from time to time, till it is evident that solution is complete. All that is then necessary is to set aside to clear, pour off the clear, supernatant fluid, and filter the rest. It is best to allow a month or two for subsidence, for the insoluble part occupies so large a space that much waste through evaporation, etc., is caused if an unnecessarily large quantity be passed through the filter.

We may say we have seen many thousands of negatives covered with a varnish prepared by this formula—both collodion and gelatine—and have not seen a single one that has given way in the slightest degree; hence we feel that the above may be recommended as a standard and reliable formula.—*British Journal of Photography.*

A Remarkable Sand Dune.

The Reno, Nev., *Gazette* describes a remarkable hill of moving sand in the eastern part of Churchill County, Nevada, about sixty miles from Land Springs Station. It is about four miles long and about a mile wide.

In the whole dune, which is from 100 to 400 feet in height, and contains millions of tons of sand, it is impossible to find a particle larger than a pin head. It is so fine that if an ordinary barley sack be filled and placed in a moving wagon, the jolting of the vehicle would empty the sack, and yet it has no form of dust in it, and is as clean as any sea beach sand. The mountain is so solid as to give it a musical sound when trod upon, and oftentimes a bird lighting on it, or a large lizard running across the bottom, will start a large quantity of the sand to sliding, which makes a noise resembling the vibration of telegraph wires with a hard wind blowing, but so much louder that it is often heard at a distance of six or seven miles, and it is deafening to a person standing within a short distance of the sliding sand.

A peculiar feature of the dune is that it is not stationary, but rolls slowly eastward, the wind gathering it up on the west end and carrying it along the ridge until it is again deposited at the eastern end. Mr. Monroe, the well-known surveyor, having heard of the rambling habits of this mammoth sand heap, quite a number of years ago took a careful bearing of it while sectioning Government lands in that vicinity. Several years later he visited the place, and found that the dune had moved something over a mile.

Fast Work in a Carriage Shop.

At the annual dinner of the Carriage Builders' National Association, in Philadelphia, Hon. Phineas Jones told of fast work he had lately witnessed in a carriage factory that turns out from 15,000 to 20,000 carriages a year. He said:

"I saw them setting tires. I noticed how fast they put the tires on the wheels. They put on 53 sets of tires in 50 minutes. That is work, and it is a fact. One man put the tires into the oven and took them out after they were heated. There were about 16 tires heated all the time in the oven, and then there were two rollers driven by a belt revolving all the time, with a strong fire at the rear of it, and when the tires were taken out, two other men stood there and put them on. I timed them, and they put on a set a minute. And the man told me that one day, when the tire setter wanted to be away the next day, and it was then five o'clock in the afternoon—he told him those wheels had got to be tired the next day, and he said: 'I will tire them to-night.' There were 53 sets of them, and he put them on in 50 minutes. Those are facts. I noticed one man setting tires, and I timed him with my watch. He lit the forge and put on a tire a minute. I said that is lively work."

THERE are in the United States about 28 establishments devoted to the manufacture of matches.

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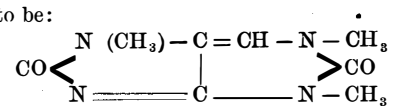
Tea and Coffee from Guano—Synthesis of Coffeine (Caffeine).

Theobromine, the crystalline body present in cacao beans, and first recognized by Woskresensky, in 1841, and caffeine, first met with by Runge, in 1820, and afterward found in tea and termed theine, but which has since been shown to be identical with caffeine, are the two bodies which the chemist has now succeeded in producing artificially. The *Engineer* says that Mr. Emil Fischer has for a long time busied himself with the investigation of the constitution of the caffeine contained in coffee and tea, and a short time since he arrived at a structural formula for this base, which he found to be:



He it is who has now succeeded in preparing the base artificially. He has not, it is true, succeeded as yet in preparing it from the elements composing it, but from a body of quite other origin, a substance present in urine, in meat, in the muscular part, that is to say; and in guano, to wit, xanthine. The three bodies, xanthine $C_5H_4N_4O_2$, theobromine $C_7H_8N_4O_2$ (the alkaloid present in cacao), and caffeine $C_8H_{10}N_4O_2$, are closely related to each other in point of constitution. The last two differ in formula by CH_2, and the first and second by C_2H_4 or $2 \times CH_2$; and it has been shown by Strecker that theobromine and caffeine can be converted the one into the other by taking an atom of hydrogen out of theobromine and inserting in its place the methyl group CH_3. He brought about this change by treating argentic theobromine with methyl iodide in accordance with the equation:

$C_7H_7AgN_4O_2$	+	CH_3I	=	AgI	+	$C_8H_{10}N_4O_2$
Argentic theobromine.		Methyl iodide.		Argentic iodide.		Caffeine.

In a similar way, Strecker tried in vain to obtain theobromine from argentic xanthine. It was reserved for Fischer to be more lucky, by treating the lead salt of xanthine in place of the silver salt with methyl iodide, to produce theobromine, as shown below:

$C_5H_2N_4O_2Pb$	+	$2CH_3I$	=	PbI_2	+	$C_7H_8N_4O_2$
Plumbic xanthine.				Plumbic iodide.		Theobromine.

The theobromine thus artificially obtained is in every respect identical with that of the natural alkaloid of the cacao bean. When converted into its silver salt and treated with methyl iodide, it is changed into caffeine, and thus the characteristic alkaloids of cacao, of coffee, and of tea had now been artificially prepared out of guano.

Substitute for Albumen for Fixing Dyes, etc.

J. Hofmeier, Prague, converts the albuminoids of all kinds into soluble proteines and pepton-like substances, and mixes these products with substances that will precipitate or coagulate them at an elevated temperature.

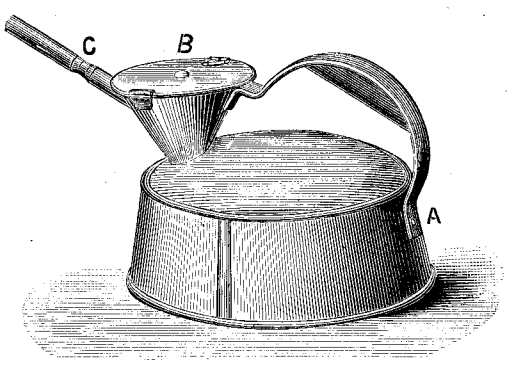
The raw albuminous substance employed is the waste product in making extract of meat, such as insoluble crude albumen meat meal, and other kinds of waste meat, as well as fresh meat itself, the fibrine of blood, dry or fresh, caseine, moist or dried, and finally vegetable substances that contain albuminoids, such as the germs of malt, pressed oil cakes of various oil seeds, and the albumen of legumes and pod bearing plants.

The different kinds of albumen are dissolved either by heating with dilute acids, such as hydrochloric or lactic, or by prolonged boiling in weak solutions of alkali, especially caustic soda. The solution thus obtained, if made with an acid, must be neutralized as far as possible without precipitation. It can then be dried carefully at 35° C. (95° Fah.), forming a solid mass which will dissolve again in fresh water like ordinary albumen, and its solution can be employed with other substances for dyeing and printing, just like other albumen, by mixing it with the color. After printing it is coagulated by steaming, and fixes the dye on the fiber. The substances employed to mix with it are the various soluble salts of lime and magnesia, with the addition of common salt and sulphate of potash. Instead of these salts the same end may be attained by the use of the salts of alumina, zinc, or baryta, which possess the property of forming basic salts by the action of water at higher temperatures. The following are recommended as most suitable, namely, to each 100 parts of albumen in the solution, calculated to substance dried at 100° C. (212 Fah.), from one to two parts of lime or magnesia salts are used, the most suitable being chloride of calcium, chloride of magnesium, sulphate of magnesia, or citrate of lime. The amount of common salt added is five to six parts to 100 of dry albumen in the solution; the quantity of sulphate of potash is 0·25 to 0·40.

The mixtures prepared in this way become insoluble when dry, and hence can only be used in a liquid form. Yet other mixtures can be made that will bear being dried at 35° to 40° C. (95° to 104° Fah.) without producing an insoluble residue, and it can then be redissolved in lukewarm water, and by steaming or heating to 100° C. (212° Fah.) it will coagulate like other albumen. The proper substances to be added for this purpose are salts which decompose under the influence of heat and in the presence of feeble alkaline substances, like protein alkali, liberating an acid or increasing the basicity of its own acid. Certain organic acids are of this nature, especially the sulpho-acids, the acid esters of sulphuric, succinic, and phosphoric acids; likewise the salts of meta and pyrophosphoric acid, as well as the biborates, all of which possess the property that when their solutions are heated, even with substances that are but slightly alkaline, they split up and liberate an acid hydrate which neutralizes the soda that kept the albumen in solution, hence causing its precipitation in insoluble form. Glycol-sulphuric and glycol-phosphoric acids and their potash or lime salts are especially useful, but glycol-succinic and glycero-succinic acids can be employed, as well as the analogous citrates, tartrates, and lactates, the alumina zinc and baryta salts being preferred. The pyrophosphates and metaphosphates of lime and of soda are also employed.

The quantity of these salts employed only amounts to 1 or 2 per cent of the dry albumen, and in the case of the glycero-sulphates of lime and potash it can be reduced to a half per cent, if the amount of alkali in the albumen solution is correspondingly decreased. Such mixtures, with the addition of 6 or 7 per cent of the dry weight of albumen of common salt, can be completely dried, yielding a mass that looks just like blood albumen and dissolves readily, forming solutions that coagulate completely when steamed on the fibers. By the use of albuminoids that are nearly colorless, like caseine and vegetable albumen, preparations are obtained lighter in color than egg albumen itself, and not inferior in fixative power.—*Ind. Zeitung.*

In the treatment of bronchial and other throat affections, it is usual to inhale steam impregnated with medicated substances, for soothing the irritation or curing the disease. The accompanying cut of a kettle we find illustrated in



one of our foreign exchanges, which seems to be quite a simple and convenient utensil. The cut explains it. A contains the boiling water; B, the receptacle for the herbs; and C, the inhaling tube.

How to Kill Cabbage Worms.

The ravages of the caterpillars of the cabbage butterfly caused a good deal of trouble last summer at the State Agricultural Experiment Station, Geneva, N. Y., particularly those of the second or August brood. In order to test the efficacy of various reputed remedies for the cabbage worm, the director applied them to special collections of worms, and noted the effects. One specimen confined for three hours in a bottle partly filled with black pepper crawled away discolored by the powder, but apparently unharmed. The second, repeatedly immersed in a solution of saltpeter, and a third in one of boracic acid, exhibited little indications of inconvenience. Bisulphide of carbon produced instant death when applied to the worm, though its fumes were not effectual. The fumes of benzine as well as the liquid caused almost instant death, but when applied to the cabbages small whitish excrescences appeared on the leaves. Hot water applied to the cabbage destroyed a portion of the worms, causing also the leaves to turn yellow. One ounce of saltpeter and two pounds common salt dissolved in three gallons of water formed an application which was partly efficient. The most satisfactory remedy tested, however, consisted of a mixture of ½ lb. each of hard soap and kerosene oil in three gallons of water. This was applied August 26; an examination the following day showed many, if not all, the worms destroyed.

The growing cabbage presents such a mass of leaves in which the caterpillars may be concealed that it is hardly possible to reach all the worms at one application. It is of importance, therefore, to repeat the use of any remedy at frequent intervals.

Japanese Sugar.

The sugar of Japan, says Consul-General Van Buren, is made from that species of the sorghum plant known as the Chinese sorghum. It grows luxuriantly in all the southern portions of the empire south of the 36th degree of north latitude. The whole product of the empire in 1878 was 64,297,580 pounds. Importation in 1878 was 67,434,805 pounds. For three or four hundred years the processes of granulating and refining sugars have been known and practiced. Sorghum is not grown, as with us, from the seed, but from cuttings. In September selected stalks are cut and buried in trenches a foot deep. Through the winter, from each joint of the stalks sprouts grow. In the spring these points are cut off and set out in rows 15 to 18 inches apart, and about the same distance from each other in the rows. The ground has previously been thoroughly dug up, and pulverized by a long-bladed mattock. The fertilizers used are ashes, fish, decomposed hay, straw, and sea-weed, or night soil. The plants are thoroughly hoed, hilled, and irrigated. In October and November the leaves are stripped off and the stalks are then cut and the hard outer covering is removed, and the remaining portion is then ground between rollers of stone or hard wood. The cane juice is then boiled in iron kettles till the granulation takes place, when it is placed in bags and pressed dry. The expressed sirup is used as molasses. Dry upland soils are required for the successful growth of the cane, and the expenditure of labor and fertilizers is as great if not greater than for any other crop. Great exertions are being made to promote the increased production of sugar, which will probably be in some degree successful. In fact, I am informed that large orders for the apparatus for sugar-making have been received from districts which heretofore have not grown sugar-cane.

Crystallization Experiments.

When two different salts are dissolved in the same liquid, such an exchange of bases and acids takes place as will form, if possible, an insoluble salt. Thus barium nitrate and sodium sulphate will form barium sulphate (precipitated) and sodium nitrate. When, however, the given acids and bases are unable to form an insoluble compound, as when barium nitrate and sodium chloride are brought together, it is not easy to see what does really occur. Berthollet says that in such cases four salts are formed and exist in solution. Thus, in the case last mentioned, we should have both of the original salts as well as barium chloride and sodium nitrate. The following experiments of Brugelmann are designed to prove this:

1. Equal volumes of cold saturated solutions of cobaltous chloride, $CoCl_2 + 6H_2O$, and nickel sulphate, $NiSO_4 + 7H_2O$, are mixed and left to evaporate spontaneously. The crystals contain both metals in the form of sulphates, hence the mother liquid must contain chlorides of both metals, making four salts in all.

2. Similar experiments made with cobaltous chloride and copper sulphate yield at first a crop of large wine-red crystals, consisting chiefly of sulphates of both metals, but mixed with these were also crystals of the chlorides.

3. Mixtures of copper sulphate and potassium bichromate ($K_2Cr_2O_7$) gave at first light green crystals, consisting chiefly of sulphates of the two metals. There were also yellowish-green, green, and bluish-green objects formed. Finally, there was left a dark brown, deliquescent mass, which became crystalline when dried in a desiccator, and contained both metals, mostly united with chromic acid. The details are given in the Berlin *Berichte*, xv., p. 1,840.

Potash in Greenhouses.

An experienced gardener, among other insecticides, recommends the use of potash in the greenhouse as providing a remedy against most insects, but also fertilizes the plants. He says: "I use it for cleaning the glass, swilling all wood and brick work everywhere inside, and find it useful both for cleansing and as an insecticide; and I think it is a good dressing for the soil. I have used it as strong as one ounce to the gallon of water for syringing glass over plants, and it has not injured the leaves; on the contrary, improved them. However, I would not advise its use in this way carelessly; but used as I have described, it gets into every crack and crevice, dealing certain death to the insect tribe. I would strongly advise all who have not had a thorough experience of the different kinds recommended to be very cautious in their use of insecticides and note carefully their results, as many are more dangerous than useful. Paraffine, for instance, when applied to plants in any form whatever, kills the insects; but how often does it close the pores of the leaves and makes the plants unhealthy, and, as a consequence, more liable to future attack from insect pests."

The Chief Cities of Europe.

Recently there have been compiled from official and late sources, statistics of population for some of the principal cities of Europe, from which it appears that there are 92 towns in Europe to which the term city can properly be applied, that have a total population of more than 100,000; but there are only four cities that possess more than 1,000,000 inhabitants. These four are London, with 3,832,440; Paris, with 2,225,910; Berlin, with 1,222,500, and Vienna, with 1,103,110. Of the other capitals, St. Petersburg possesses 876,570; Constantinople, 600,000; Madrid, 367,280; Buda-Pesth, 360,580; Warsaw, 339,340; Amsterdam, 317,010; Rome, 300,470; Lisbon, 246,340; Palermo, 244,990; Copenhagen, 234,850; Munich, 230,020; Bucharest, 221,800; Dresden, 220,820; Stockholm, 168,770; Brussels, 161,820; Venice, 132,830; Stutgardt, 117,300. In addition to these, Moscow contains 611,970; Naples, 493,110; Hamburg, 410,120; Lyons, 372,890; Marseilles, 357,530; Milan, 321,840; Florence, 169,000; Antwerp, 150,650; Cologne, 144,770; Frankfort, 136,820; and Rouen, 104,010.

Street Railways in the United States.

A meeting of street railway officials was held in Boston, Dec. 12, for the purpose of forming a National Street Railway Association. The temporary chairman, Mr. Moody Merrill, of Boston, in outlining the scope of the proposed organization, said that there are now organized and doing business in this country and Canada 415 street railway companies. These companies employ about 35,000 men, and run 18,000 cars. More than 100,000 horses are in daily use, to feed which it requires annually 150,000 tons of hay and 11,000,000 bushels of grain. These companies own and operate over 3,000 miles of track. The whole number of passengers carried annually is over 1,212,400,000. The amount of capital invested in these railways exceeds $150,000,000. Messrs. C. B. Clegg, of Ohio, and C. C. Woodruff, of New York, were chosen secretaries.

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New Car Signal.

The Providence & Worcester Railroad has been supplying its cars with an apparatus enabling the conductor to signal to the engineer by blowing the whistle from any portion of the train. The appliance is described as being somewhat similar to the automatic air-brake, and consists of a pipe running underneath the cars, with couplings at either end. Attached to the pipe at one end of each car is a smaller pipe running to the top and across to the center, where a valve is fixed. Over this valve is the hole for the signal rope, which is attached to the valve. When the conductor wishes to signal he pulls the rope, which runs through the car, the same as he formerly pulled the bell rope. This opens the valve, the air escapes, and the whistle is sounded by the release of the air from the pipes. The advantage of the new arrangement is readily apparent. With a long train the conductor was formerly obliged to give a long pull at the bell rope, ofttimes bringing it half way to the floor of the car, and even then was not sure that the bell rang, or that it responded to his signal as he wished it to do, while, as a matter of fact, it often did not respond. Now he has only to pull a rope the length of the car at most, and can readily tell whether or not the valve responds, knowing that if it does the whistle is giving the desired signal to the engineer. In case one of the cars in the train is not provided with this new arrangement, the bell-rope is hitched as usual, and if the conductor wishes to signal from that car it is simply necessary to pull the rope, thus opening the valve in the next car. A number of the cars of the above road are said to have been fitted with the new arrangement, which, it is understood, will be applied to all.

NEW POTATO DIGGER.

We give an engraving of an improved potato digger recently patented by Mr. Charles W. Dutcher, of St. Andrews, New Brunswick, Canada. This machine is provided with a share attached by hinged connection to the main frame, and capable of being elevated or depressed by means of a lever near the driver's seat. The share is ribbed longitudinally in the middle to thoroughly break up the hills of potatoes, and is provided with a slotted rear extension, over which the potatoes are crowded on their way to a shaker pivoted at the rear of the share and capable of lateral motion.

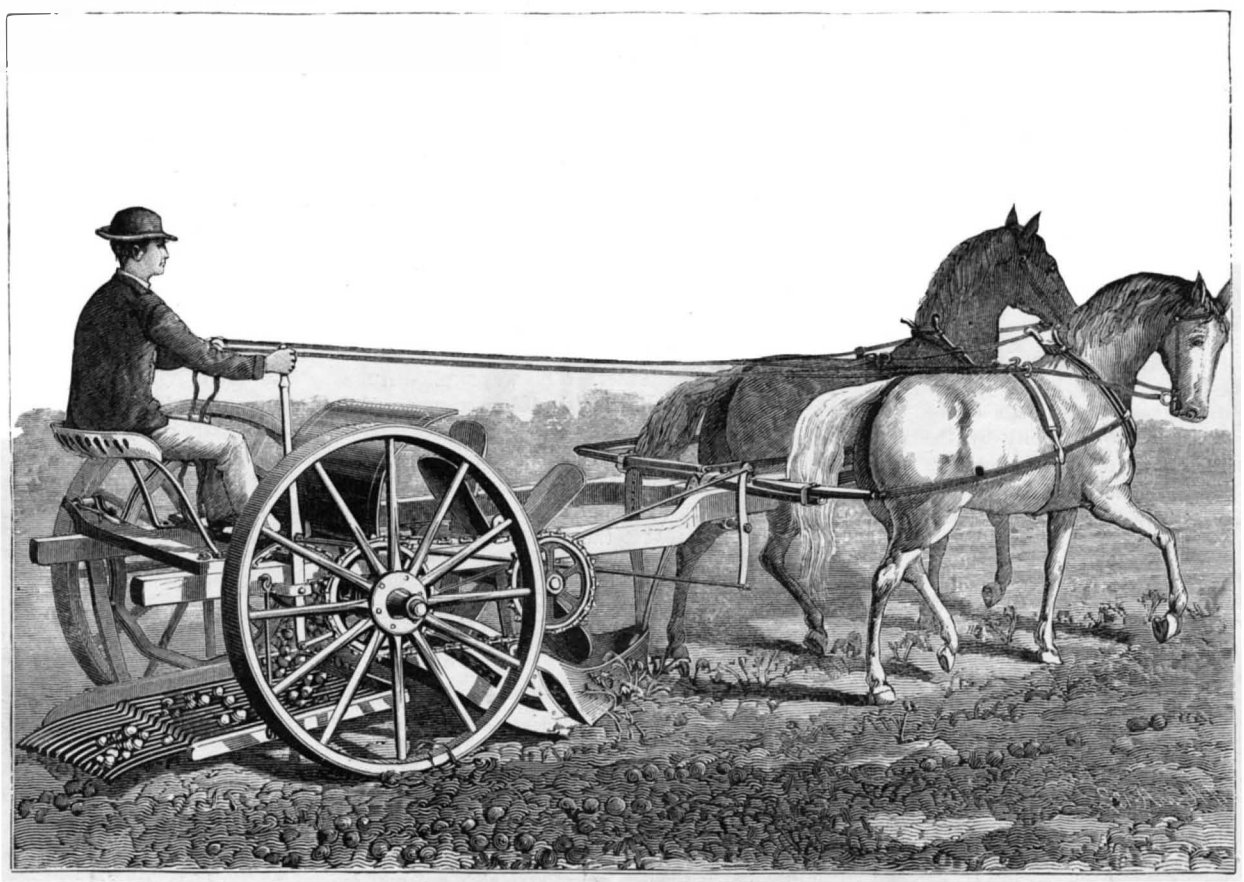
Above the share there is a scraper for clearing the ground of weeds, potato tops, stones, etc., to prevent them from entering the separating devices and becoming mixed with the potatoes; above the share there is a paddle wheel driven by a chain from a sprocket wheel on one of the drive wheels. This paddle wheel pushes the earth and potatoes backward to the separating bars. The separator shaker consists of a number of bars bent at their rear ends toward the right hand side of the machine, and having a downward offset to facilitate the discharge of potatoes. The left hand side of the shaker is provided with a rim that prevents the potatoes from being discharged on that side, and so insures a clear track for the horses and machine on the next round.

The shaker receives its motion from a zigzag cam carried by one of the drive wheels, and its motion is more rapid toward the discharge side of the machine than it is toward the opposite side, the object being to insure a uniform and proper deposit of the potatoes after they are raised from the ground and cleaned.

The raising and lowering of the main frame together with the share is effected by turning the tongue in its socket by means of the hand lever before described, and by the same means the share is raised sufficiently high to clear the ground when it is desired to transport the machine from one field to another.

Another lever is provided for throwing the sprocket wheel that operates the paddle wheel in and out of gear.

A guard consisting of a curved plate of iron is placed at the rear of the paddle wheel to protect the face of the driver from earth that might otherwise be thrown in his face. This machine is simple in its construction, rapid in its operation, and deposits the potatoes in a clean row on the surface of the ground, so that they may be readily picked up and placed in the baskets.



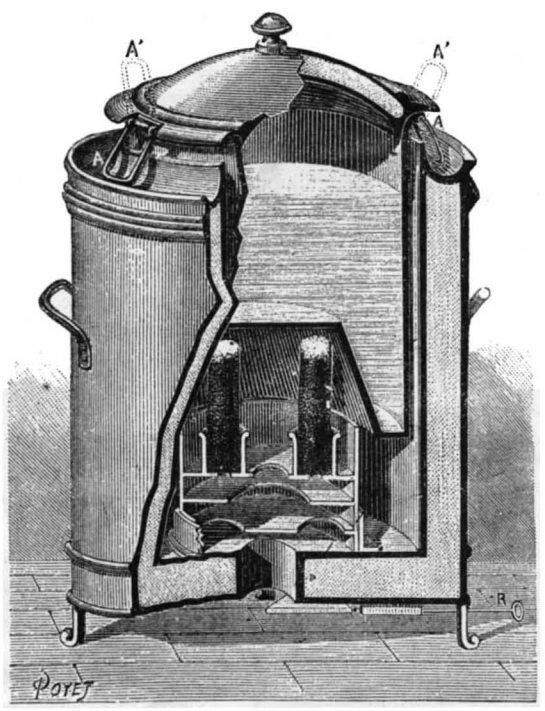
DUTCHER'S POTATO DIGGER.

THE Hudson River Power and Paper Company have completed a new dam across the Hudson River at Mechanicsville, N.Y. It is 1,000 feet long, 16 feet high, 18 feet wide at base and 8 feet at top, with its canal it has cost $200,000. It will furnish 4,000 horse power.

LABORATORY APPARATUS FOR HEATING WATER.

The accompanying cut represents a very useful little apparatus for laboratories that are unprovided with gas, and in which the heating of water by alcohol would cost too much. It is called the "American" kettle, and is heated very cheaply with an asbestos carbon. The laws of thermics are applied in this apparatus very intelligently.

The furnace consists of a double jacket, filled in with materials that are poor conductors of heat. Above the aperture in the bottom for admitting air there is a small sheet iron fire-pan, having a double bottom pierced with alternating holes, so as to prevent the ashes from falling outside, and to heat the air of combustion better. In this fire-pan there



APPARATUS FOR HEATING WATER.

are fixed one, two, or several asbestos carbons, according to the number of holders. The boiler, the bottom of which is concave, descends on the fire-pan in such a way as to allow the escape of none of the heat that acts within the hollow part. A very thin annular space suffices for the draught. With two carbons, of 100 x 70 x 25 millimeters, three liters of water may be caused to boil in thirty minutes at an expense of ten centimes; and the heat may be kept up seven or eight hours on lowering the kettle and closing the lower register, *r*. The handles, A, of the kettle are calculated to give just the draught necessary when, on being turned down (as in the cut), they raise the apparatus on its furnace.—*La Nature.*

GLASS SHINGLES.—The *Brick, Tile, and Metal Review* reports a new use of glass for shingles. It is claimed that glass roofing is at once better, more durable and cheaper than slate. The glass is usually opaque, but may be translucent or clear as desired. The exposed parts of the shingles are corrugated. The shingles lap at the sides, are closely interlocked, and one rivet suffices for a pair of shingles. It takes but 150 of these shingles 8 by 12 inches to cover a square of 100 square feet, the waste is so small; whereas of slates of the same size 300 are required.

New Journal Bearing.

A recent improvement in linings for journal boxes, for car axles, and other purposes, of which Mr. Ferdinand E. Canda, of 52 William street, New York, is the author, consists in taking advantage of the well-known unguentous or anti-friction qualities of mercury. He makes an amalgam of tin in which any of the well-known metals or alloys used for bearings are employed as constituents with mercury.

While the mass is in a plastic state it is subjected to pressure to expel the superfluous quicksilver, and then allowed to harden; the journal box is then ready for use. Plumbago or other suitable anti-friction substances may also be introduced into the amalgam if desired. It has been found by experiment that this new journal box metal has superior qualities as an anti-friction substance, and it promises to form an economical, durable, and most useful material for railway axles, and bearings of every description.

Meteors.

In a letter to a friend in Boston, an officer of the United States steamer Alaska gives an account of a meteor which was seen from the ship on the evening of December 12, 1882, a few minutes after sunset in latitude 38° 21′, longitude 134° 7′. All at once a loud, rushing noise was heard, like that of a large rocket descending from the heavens with immense force and velocity. It proved to be a meteor, and when within ten degrees of the horizon, it exploded with much noise and flame, the fragments streaming down into the ocean like great sparks and sprays of fire. The most wonderful part of the phenomenon then followed, for at the point in the heavens where the meteor burst there appeared a figure shaped like an immense distaff. all aglow with a bluish light of intense brilliancy. It kept that form for perhaps two minutes, when it began to lengthen upward, and growing wavy and zigzag in outline, diminished in breadth until it became a fine, faint spiral line, at its upper end dissolving into gathering clouds. It remained for about ten minutes, when it began to fade, and finally disappeared.

The captain of the Bark Gemsbok, arrived at this port from Auckland, December 27, reported that on October 9, during a southwest gale and thick snow squall, a ball of fire passed across the ship, injuring three seamen and breaking both gunwales, and ripping the planks from the stern of the starboard boat, and exploded about twenty yards from the ship with a loud report, sparks flying from it like rockets. There was no lightning or thunder at the time.

A large and brilliant meteor was seen at Concord, N. H., on the afternoon of December 20, between four and five o'clock. It passed across the northern sky from west to east, and was as plainly visible as meteors usually are after dark.

Improvements in Letter Copying.

The process utilizes the well-known glue plate, consisting of glue, water, and glycerine, but with rather more glue than in the hektograph. For writing, a strong alum solution is used, colored slightly with an aniline color to render it visible. The glue plate is moistened with a sponge, and after a few minutes the written paper to be copied is laid down upon it; in taking it off after a minute or two, the characters are seen to be etched or engraved in the glue. By means of a caoutchouc roller a little printer's ink is spread over the plate. Impressions may then be taken off on slightly damp paper. The ink roller requires to be passed over previous to each impression being taken. Herm O. Lehn, of Charlottenburg, has also recently patented an improved copying apparatus, in which a specially prepared moistened paper is stretched in a frame, the original writing is placed upon it, and left for one to two minutes; after removing it again, the negative or prepared paper is spread over with ink, and the copies are taken. The following process is patented by Komaromy in Buda-Pesth: The following mixture is painted over paper impervious to water—1 part gelatine, 5 glycerine, 0·2 Chinese gelatine, and 1 water. The manuscript is written with the following solution—100 parts water, 10 chrome alum, $5H_2SO_4$, 10 gum arabic, and then laid on the first paper. An aniline color solution is now poured over it, and the excess removed with silk paper. Those parts which have been touched by the prepared ink become hard and incapable of taking up the aniline color solution, and the remainder becomes deeply colored. By placing clean paper over it, negative impressions are obtained.

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The Early History of Photography and the Daguerreotype Process.

A.D. 1556. The alchemists noticed that horn silver (fused silver chloride) blackened when exposed to the sun's rays.

1777. Scheele, the great Swedish chemist, discovered that silver chloride is very readily darkened by blue light, and very little or not at all by red light (origin of the employment of red glass in our dark rooms). He also proved that when this darkening occurs chlorine is liberated, and that the darkened salt acted upon by ammonia leaves a residue of metallic silver.

1801. Ritter extended Scheele's experiments. He found that silver chloride darkens in the space beyond the violet end of the spectrum, demonstrating the existence of rays which do not excite vision. These are now called the "ultra-violet rays." Ritter also observed that the red (least refrangible) rays not only do not darken silver chloride, but that they actually whiten silver chloride that has been darkened in the blue (more refrangible) rays.

1802. Wedgwood, the great potter, and Sir Humphry Davy coated paper and leather with silver nitrate and silver chloride, and obtained profiles by the agency of light. They, however, could not fix the pictures thus produced.

1827. Niepce came to England, and brought specimens of pictures taken in the camera. He discovered the property of light of rendering various resins insoluble in their solvents.

1839. The daguerreotype process was published in this year, and Mr. H. Fox Talbot communicated his paper process to the Royal Society, and first produced negatives. Mungo Ponton also this year discovered that potassium bichromate when on paper altered in composition by exposure to light.

1840. The Rev. J. B. Reade accidentally observed the development of the latent image in the Talbotype process with gallic acid.

1841. The calotype process introduced by Fox Talbot (description postponed).

1843. Sir John Herschel first took pictures on glass, and recommended the use of hyposulphite of soda for fixing.

1851. Mr. Scott Archer and Dr. Diamond introduced the collodion process in a practical form.

THE DAGUERREOTYPE PROCESS.

A silvered copper plate is polished with tripoli and rouge and chamois leather buffs until the surface is quite free from scratches, when it is exposed to the fumes of iodine for about three minutes, or until the surface presents a bright yellow color, and then to bromine until it assumes a violet hue, when it is ready for exposure. After exposure no image is visible, but on placing the plate above mercury heated to about 150° Fahr., it rapidly appears, the lights being represented by an amalgam of mercury and silver, and the shadows by silver. It is fixed by immersion in a ten per cent solution of hyposulphite of soda. After washing, the image may be intensified by pouring on the plate mixed solutions (very dilute) of gold chloride and hypo., and heating over a spirit lamp. The picture should be protected with a glass plate.

Theory of the process.—The iodine (and bromine) attacks the silver, forming a thin film of silver iodide, Ag I. On exposure to light this is reduced to subiodide—

$$2\,Ag\,I = Ag_2\,I + I.$$

The silver underneath the film acts as a sensitizer, combining with the iodine set free to form fresh iodide. On development, the nascent atoms of silver in the subiodide form an amalgam with the mercury.—*E. Howard Farmer, in British Journal of Photography.*

Healthy and Profitable.

Some industrious Gothamite, bent upon tearing the mask from some popular idol, and holding it up before an admiring world in its true light, has taken advantage of the interest in sanitary reform awakened in this city by the beneficent workings of the new law, to reveal some matters of which he has possessed himself concerning sewer gas, plumbers, wealth, etc. Since the discovery of the deadly sewer gas, and the creation of sanitary engineering as its uncompromising foe, the occupation of the plumber has come to be looked upon almost as one of the high arts. The *Tinner and House Furnisher* claims that the plumber has, as it were, become master of the situation; at least, he has taken advantage of it to bring in bills longer than the moral law, and ranging higher than those of doctors and undertakers. Plumber's solder, it has been said, has become as expensive as the gold filling with which dentists plug up cavernous teeth. Of course, the plumber whose health must be prejudiced in order to save that of other people must be allowed the privilege of rak ing in the shekels, untrammeled by nice discriminations as to the relation of the service performed to the length of his bill. But all this is now changed. Plumbers must step down; for it is set forth that plumbers not only enjoy better health, but that they live longer and die gamer than any class of men except professional office holders. Considering their extortions, the knowing New Yorker thinks the death rate among them is not half as great as it should be. He finds no names of plumbers' widows in the Directory, nor any children of plumbers in orphan asylums. He thinks, therefore, sewer gas must be a healthy, life-giving thing, and is considering the propriety of organizing a society for bottling it up to supply to people in the country, who are denied this luxury.

AN ORNAMENTAL WATER JAR AND BASIN.

In the baronial halls of Germany curious and artistic brass reservoirs for holding water are frequently found suspended upon the tapestried walls for the service of guests as they enter the castle. These are usually in shape like old English coffee urns without the stand, and are often engraved with the family coat of arms of the proprietor of the establishment. Underneath the tank is placed, either upon a table, or suspended upon the wall, a basin similar in decoration and style, and calculated to receive the water as it is drawn from the supply above. These were placed either, as suggested, at the entrance hall, or near the exit of the banqueting room, so that the guests could moisten their fingers in the perfumed stream before taking part in the dance. Many of these old pieces may now be found in Germany, and are much sought after by connoisseurs and art collectors, not only for their antiquity and the associations connected with them, but for their decorative and artistic value. The tank and basin given in our illustration is a reproduction of one of these old pieces mounted upon a wrought iron stand, and produces an effect at once striking and graceful, and furnishes an article which would be a handsome and practical adjunct to a modern house.

ORNAMENTAL WATER JAR AND BASIN.

Recent Armor Plate Trials.

An important trial of armor plates was recently made at St. Petersburg on Wilson compound—steel faced—armor and Schneider's Creusot steel armor. The experiments were made 24th November, 1882, at Ochta, near St. Petersburg, on two plates, each 8 feet long by 7 feet wide by 12 inches thick; weight of each about 12¼ tons. The *Engineer* says that one plate was made of steel by Messrs. Schneider & Company, of the Creusot Works, France, and the other was made on Wilson's system, one-third steel, two-thirds iron, by Messrs. Charles Cammell & Company, Limited. Both plates were backed by 12 inches of timber placed horizontally, and two three-quarter inch iron plates supported by diagonal struts. The gun used was an 11-inch Aboukoff breech-loader, the range 350 feet. The projectiles were of chilled cast iron shells, 553½ pounds English—made at Perm, in the Ural. The first shot was fired at Schneider's steel plate. The charge of powder, 132 pounds English. Velocity, 1,506 feet. The projectile was destroyed, but it broke the plate into five pieces. The penetration was 13 inches.

The second round was fired at Schneider's steel plate. The charge of powder was 81 pounds English. The shot was broken up; there was penetration 16 inches. The plate was broken into nine separate pieces. The previous cracks were opened out, three new ones being produced.

The third round was fired at Schneider's steel plate. Charge of powder was 81 pounds English, with a steel shell, Aboukoff make. Seven pieces of the plate remained hanging on to the shattered backing. One piece weighing about one ton was found 13 feet behind the target; ten pieces weighing about three tons together, were scattered on the ground in front. The projectile was found 740 yards to the rear of the target, and was apparently uninjured.

The fourth round was fired at Cammell's compound plate, with a charge of powder 132 pounds English. Velocity, 1,506 feet. The projectile was destroyed. A few cracks produced on the steel face both concentric and radial, but they were of no importance. The front of the shot had splashed on the plate, and the head remained in, so that the penetration could not be ascertained, but, judging from the diameter of the piece wedged in the shot hole, it was thought not to exceed 5 inches.

The fifth round was fired at Cammell's compound plate. The charge of powder was 81 pounds English. The result on the face could not be seen, as the remaining bolt had broken and let the plate fall on the ground face downward before the target.

The total stored up work in the first round at each plate is 8,704 foot tons, implying a power of perforating 16·3 inches of wrought iron. This was, therefore, a severe test, the shot being a full match for 12 inches of compound armor.

Brick Fronts.

The overwhelming desire for a "neat job" has done mischief in brick work. A pressed brick wall is a monotonous thing when brick is used alone. It shows only mechanical precision and exactness, and these qualities become very tiresome when they are exhibited for their own sake and not as means to an end. A slight unevenness in texture and in color helps the look of a wall, and it is the aim of the maker of pressed brick and of the builder to avoid the slightest unevenness. The best looking brick walls, except in the perverted eyes of bricklayers, are those in which the unevenness appears, that is to say, those which are built, not of pressed bricks, but of common bricks, chosen for color. To an artistic eye, for example, the wall of the recently completed addition to Mr. Hunt's *Tribune* building, which is built of selected common bricks, laid in cement, looks better than the face brick used in the principal fronts of the building, although the face brick is relieved of much of what would otherwise be its monotony by the free use of granite in combination with it. The jail attached to the Jefferson Market court house is built of selected common brick, while the court house itself is built of pressed brick, and the superiority, in this respect, of the jail must be evident to everybody who has looked at the two together.

A yet more striking instance is furnished by the new Casino, one of the most admirable pieces of brick work in New York, and the more interesting because there is no stone work worth mentioning, but the whole building is of burnt clay. The brick used here is Collaberg and Croton brick, very carefully selected, and used in the lower walls in alternate bands. The work has in consequence a beauty of color and a beauty also of texture which cannot be attained by the use of the more fashionable material.—*N. Y. Record.*

Case Hardening Low Steel.

There are a number of processes for case hardening low steel or iron. It is desirable to have a carbon covering or envelope that does not evaporate or oxidize quickly at the temperature required for hardening. As the prussiate of potash contains in its anhydrous state only about 19 per cent of carbon, while the potassium, iron, and nitrogen are nearly 80 per cent, it follows that it is too weak in carbon to be very effective in case hardening. As boiling water takes up nearly its own weight of prussiate of potash, a saturated solution may be made, to which is added as much bone charcoal, bone black, or charcoal from leather or horn as will take up the solution, or as much as can be made wet; the mass is then spread out and thoroughly dried in an oven. It will then be ready to mix with whatever may be used to make it adhere to the steel, such as oil, grease, or any other sticky substance. Bone, leather, or horn charcoal can be made by roasting it at a low red heat in a closed vessel, so close that no air can injure the product. A crucible or iron box covered with clean sand will do.

Where a Dollar Makes a Millionaire.

A Russian traveler in the Malay peninsula claims to have found in use there the smallest "coin" in the world. It is a minute wafer made from the juice of a tree. Its value is about the millionth part of a dollar.

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WHAT IS A PIKE?—WHAT IS A PICKEREL?

What is the difference between a pike and a pickerel? is a query that has bothered the majority of intelligent anglers who have not the inclination or the leisure to study the structural differentiation of these two fishes as given by the text books. We will try to help them without dealing too elaborately in technical description, and by giving an engraving of each of the representative fish indiscriminately called pike and pickerel. First, the wall-eyed pike, so called.

This fish is not a pike, but a perch. In the West it is commonly called the wall-eyed pike, the Ohio salmon, the glass eye. In the State of New York it is known by the former name, and also that of pike perch. In the Southwest as the jack or jack salmon. In Pennsylvania as the Susquehanna salmon; and its common name in Canada (we are open to correction) is the dory or yellow pike. It may be distinguished at a glance from the genus *Esox* or pike, by the position and shape of the fins, and by its compressed body, as compared with that of the pike. We do not care to give minute structural differences, as the engraving of the pike shown will enable any angler to identify either fish as soon as his eye rests upon it. The general color of the "wall-eye" is that of a dark olive, with fine brassy mottlings; and it may be known at once by a large black spot on the last rays of the spinous dorsal fin, which is otherwise nearly or quite unmarked. There is a variety of this fish (*S. salmoneum*) which is locally called the "blue pike" and "white salmon." It is bluer in coloration than the wall-eye, and the body is proportionately shorter and thicker, and has silvery instead of the brassy mottlings of the former fish. It seldom grows more than a foot in length, whereas the wall-eye has been caught ranging up to forty pounds.

There is still another species of these pike perch—the sand pike (*Stizostethium canadense*). This fish also seldom attains a greater length than fifteen inches, and may be distinguished at sight from others of the same species by its beautiful markings, being of an olive gray, with pale orange on the sides, thickly mottled in black. The first or spinous dorsal fin (which, in a specimen presented to us by Charles Hallock, Esq., is marked by variegated translucent tints) has two or three rows of round black spots upon it, and there is also a large black blotch on the base of the pectoral fin. So much for the pike perches, or pirate perches.

Bear our engravings in your mind, and whenever you speak or write about these fish, call them perches, not pikes, or, better still, give us the scientific name *stizostethium*, a jaw-breaker to pronounce, but a pretty word to look at as the representative of a noble game fish.

And now to try and solve the angler's conundrum—what is a pike? what is a pickerel? First, a letter from Professor Spencer F. Baird, in response to a query of "Old Izaak" which was prompted by a social chat and discussion when friend Morrell paid his last visit to our sanctum. Professor Baird wrote as follows:

DEAR SIR: In England the young of the pike (*Esox lucius*) is called "pickerel,"* there being only one species of the genus *Esox* in Western Europe. In this country, where we have several species of this genus, the use of names is somewhat different; but ordinarily the words "pike" and "pickerel" describe distinct species of fish. The pike of our great lakes, called pike almost everywhere that it is found in this country, is identical with that of Europe. The mascalonge (*Esox nobilior*) is another large species closely related. The name "pickerel" is commonly applied to the smaller species of the same genus, such as *Esox reticulatus* and *Esox salmoneus*. Our works on fishes and angling commonly limit the use of the names in the manner above stated. I have no doubt, however, that the majority of anglers, referring to these fish in a colloquial manner, would call any small representative of the genus a pickerel, and any large one a pike.

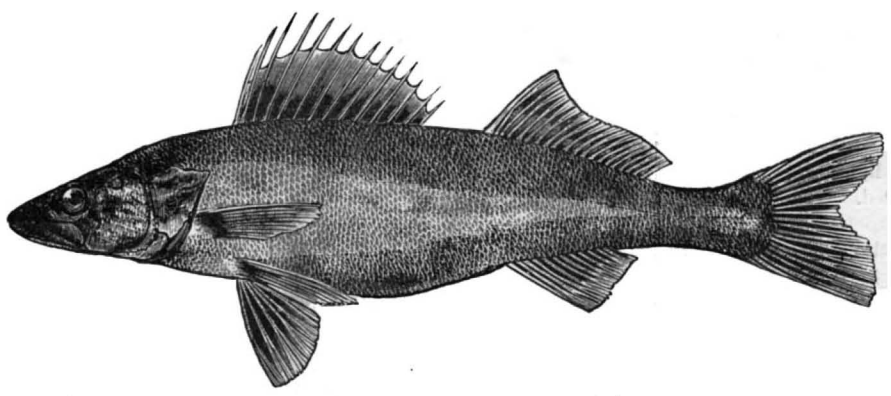
Yours, very respectfully,

SPENCER F. BAIRD, Commissioner of Fisheries.

We will give first an engraving of the pike proper—the *Esox lucius* of American waters and of those of Western Europe. It is also called the great northern pickerel, and we must charge to Wm. Henry Herbert (Frank Forester) this confusion of names. Forester knew but little of ichthyology, and less of angling. He was a charming bookmaker on outdoor sports, yet much of his work was done to order under the necessitous demands of irregular and vicious appetites; and, unfortunately, his books, for many years, were considered text authorities by the sportsmen of America; and in the case of the fish before us, his English nomenclature has been followed by Norris, Scott, and others; hence the established misnomer of pickerel for pike, and *vice versa*. Chas. Hallock was the first of modern angling authors to drop this misalliance of terms.

The second engraving shows the pike of American waters, and the cut below is that of the pickerel. Let us try and point out the prominent structural differences between these two fish, always bearing in mind that the coloration of fishes does not classify species, as it varies greatly in the same species in different waters.

First, as to general contour, which is almost identical in the two fishes. Next, as to scales, the books tell us that there are none on the lower half of the opercules or gill covers of the pike. Those of the pickerel are covered with scales. Each scale on the body of the pike has a shining



THE WALL-EYED PIKE.—(*Stizostethium vitreum.*)

V-shaped mark opening downward, which is absent on those of the pickerel.*

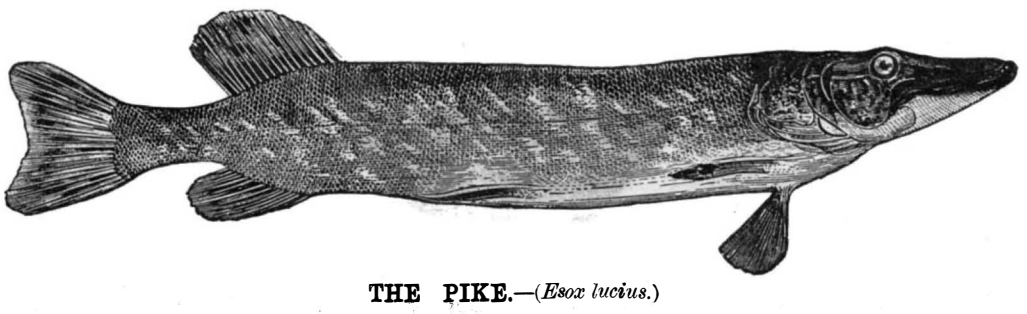
The other structural differences between the two fish, such as fin rays, number of scales on lateral line, etc., etc., would, if designated, rather confuse than make clear to the general reader the varietal line between the pike and the pickerel. Of the latter there are three other species, none of which grow to more than a pound in weight. They are called:

The humpbacked pickerel (*Esox cypho*).†

The banded pickerel—trout pickerel (*Esox americanus*).‡

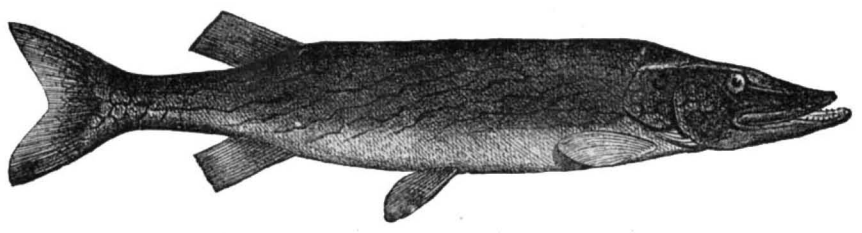
The Western trout pickerel—little pickerel (*Esox salmoneus*).

The latter is the small pickerel referred to by our correspondent "V. O." as being tasteless and bony. To sum up: Most anglers have imbibed Webster's definition of a pickerel—"The diminutive of pike"—and look upon all fish so called as being poundlings or less; and the converse is also true: a pickerel of eight pounds is to them either a misnomer or the product of a fisherman's yarn. The facts are these: The pond pickerel (*Esox reticulatus*) grows to a weight of eight pounds, and it was these fish that friend Simpson sent us from Lake Hopatcong. Thad. Norris called them the pond pike, and acknowledged a growth for them up to five pounds. The same fish are found in Greenwood Lake, but their colors are not so clear and bright, nor are they so gamy as their congeners of Hopatcong.



THE PIKE.—(*Esox lucius.*)

Using the facts before us, it seems plain that it is the *Esox reticulatus*, with its possible weight of eight or nine pounds,



THE PICKEREL.—(*Esox reticulatus.*)

that has led anglers to a confusion of identity of the pike and the pickerel. We trust that the marked differences as above noted between the *E. reticulatus* and the true pike will assist the intelligent rodster in the identification of these two fish. [The cuts we use are from the annual report of the Fish Commissioners of Pennsylvania, the ichthyological department of which was edited by Prof. E. D. Cope, the distinguished naturalist of Philadelphia.—EDITOR.]—*The American Angler.*

[* We have always been under the impression that the young pike, until it attained a weight of five pounds, was called in England a "jack."—EDITOR.]

* The common Eastern pickerel, or green pike, as it is occasionally called (the *Esox reticulatus*), is green in color, with a network of brown streaks on the sides, and is abundant in the ponds or lakes of the Atlantic States.

† The humpbacked pickerel (*Esox cypho*). This fish is a small species, and Professor Jordan says of it "that it may probably be known at once by the elevated back and broad wollen ante-dorsal region." It is found principally in the Western States.

‡ The banded pickerel, or trout pickerel (*Esox americanus*), is of a dark green color, having about twenty distinct blackish curved bars on its sides. It grows to hardly a foot in length, and is found in the Atlantic streams.

‖ The Western trout pickerel—little pickerel (*Esox salmoneus*)—is of an olive green color above and white below, with markings of network and curved streaks on the sides. There is a black streak in front of the eye and below it. This fish is found in quantities in the Western streams, particularly in the Ohio valley. It is also met with in some of the Atlantic streams, and has been caught in the Susquehanna River.

A New Explosive.

BY DR. CARL HIMLY AND HERR L. VON FRUTZSCHLER-FALKENSTEIN.

The new explosive is a mixture of saltpeter, chlorate of potash, and a solid hydrocarbon, and is suitable both for mining purposes and firearms, while, if ignited in the open air, the combustion takes place slowly and imperfectly, and therefore without danger. The incorporation of the ingredients is by preference effected as follows:

The saltpeter, chlorate of potash, and hydrocarbon (for which may be taken paraffin, asphaltum, pitch, caoutchouc, gutta-percha, etc.) are mixed together in pulverulent form by passing them through sieves or otherwise, and the mixture is then treated with a liquid volatile hydrocarbon, which acts as a solvent to the solid hydrocarbon. A plastic mass is thus produced, which is then formed into cakes or sheets by passing through rollers or otherwise, and is rendered hard by evaporating the liquid solvent used, the sheets or cakes so produced being then converted into grains or pieces of any desired size, in the same manner as ordinary gunpowder; or the cakes or sheets may be conveniently brought, while still in a plastic condition, under stamps having cutting edges arranged in polygonal form, so as to divide the mass into separate grains of corresponding polygonal shape, which are then rendered hard. By this mode of dissolving the hydrocarbon before or after admixture with the salts, the great advantage is obtained of providing the particles of the latter with a waterproof coating of varnish of the hydrocarbon, more particularly when caoutchouc or gutta-percha is used, thus protecting the compound from deterioration by moisture. The process is also simple and free from danger, as, if the pasty mass should catch fire, the volatile hydrocarbon will first burn away entirely, after which the powder will enter into slow combustion. In addition to the above mentioned advantages of freedom from danger in its manufacture and transport and from hygroscopic properties, as also the comparatively innocuous nature of the products of combustion, it may be mentioned that the compound leaves only a small solid residue, which is as innocuous as the gaseous products, and that the combustion in a confined space is complete, yielding very little smoke, which rapidly disappears. Furthermore, the new compound, which has about the same density as ordinary gunpowder and is very hard, possesses with equal volumes more than double the explosive force of the latter. The intensity of explosion can be regulated at will by varying the proportions of the ingredients and the size of the granules. These proportions should, generally speaking, be such that for each volume of the hydrocarbon, when converted into a gaseous state, there shall be present in the other ingredients three volumes of oxygen.

Pouring Oil on Troubled Waters.

At the instance of the Board of Trade, some experiments were made recently at Aberdeen Harbor entrance, with a view of testing the practicability of using oil as a means of reducing the danger to vessels entering in a gale. The occasion was most favorable. A stiff southeaster was blowing, the sea was running high, the waves dashed over the piers, and it was next to impossible for any vessel to cross the bar in safety. Captain Brice, representing the Board of Trade, and the leading harbor officials, were present. Some improvements had been made in the pumping apparatus since the last experiment, a larger hose being supplied, and seal oil being used instead of coarser oil. When the pumping commenced, the waves were dashing wildly against the piers. After twenty minutes, the London *Times* reports, the crests disappeared, the breakers assumed a rolling motion, and the entrance was rendered comparatively safe. Two hundred and eighty gallons of oil were used in the experiment. The result will be reported to the Board of Trade.

The Electric Railway in Ireland.

A private trial of the Giants' Causeway and Portrush Electric Railway took place on Nov. 21. The results were most encouraging. Several times a run of over a mile was made, and a speed of ten miles an hour was frequently attained. The motion was smooth and pleasant.

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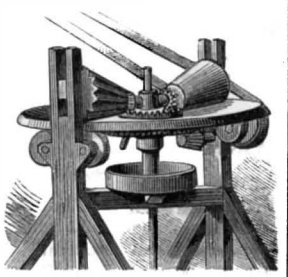
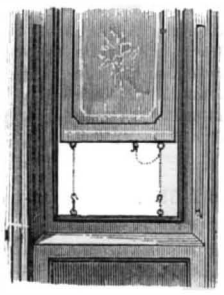
Improved Butter Worker.

The engraving shows a simple and efficient power butter worker intended to supersede the hand apparatus. A circular concave table is mounted on a vertical pivot set up on a support for an axis around which the table may revolve. A toothed bevel wheel is attached to the under side of the table for turning it by a driver shaft, to which the power is to be applied by a belt. On the upper side of the table is another toothed wheel for giving motion to the conical rollers, the rollers being mounted in adjustable outer journals that are capable of shifting up and down in slotted standards. The journals of the inner ends are capable of shifting up and down, and may be secured anywhere by a set screw. A cover incloses the pinions and wheel, and prevents the butter from working on to them. There are passages for allowing the buttermilk to escape through the table into a pan arranged on the bench under the table to receive it. One of the rollers is made plain on the surface for rolling the butter down smooth, and the roller is fluted for working it into ridges, so that it will be thoroughly worked under each roller. This invention has been patented by Mr. Elmer C. Rigby, of Dundee, Ill.



Novel Curtain Holder.

The invention shown in the annexed engraving is designed to confine the lower end of a window curtain, so that it will not flap when the window is open and the wind is blowing. The device consists of two pieces of chain, of suitable length, attached to the lower end of the curtain near opposite edges, and two hooks attached to the window sill by means of one or two links, and capable of engaging with the chains on the curtains. Two hooks are provided on the curtain stick for receiving the ends of the chains when not in use. The chains when looped up are rather ornamental than otherwise, and may take the place of tassels. The hook may be brought into engagement with any of the links of the chains, thus permitting of the adjustment of the curtain to any desired height. This invention has been patented by Mrs. Mary J. C. Throop, of 51 High Street, Portland, Me.



Cephalometer.

This is an improved instrument for taking measurements of the human head for phrenology, ethnology, anthropology, and sculpture. With it the actual measurements of all portions of the head with relation to the central point of the head corresponding with the head of the spinal column, (medulla oblongata) may be accurately taken. A graduated semicircular arc is fixed at its ends on axial pivots having hollow bulbous extensible sections, adapted to enter the openings of the cars, one of the pivots having a graduated scale, by which to register the traverse of the arc on the pivots. The bulbs have perforations to admit sounds to the ears. A scale traverses the upper arc radially, and is capable of sliding along it from end to end. An arched stay brace connects the pivots, and passes over the front of the face and carries a steady rest, which is placed on the nose. Another arched brace connecting the pivots passes under the chin. It will be seen that by the traverse of the upper arc forward and backward on the pivots, and the traverse of the radial scale along the upper arc, the relative positions of the different organs or other divisions of the head, and also the relative sizes or distances from axis, can be readily and accurately taken. Phrenologists ascribe different mental faculties to special organs or divisions of the brain, and judge of the power of a faculty by the development or size of its organ, which they determine by estimating the distance of that part of the skull where it lies from the medulla oblongata, which is situated very nearly on a line between the openings of the ears and midway between them. The instrument illustrated makes these estimates actual measurements, giving the absolute size of each part or organ—that is, the distance of its outside surface from the medulla oblongata. This invention has been patented by Mr. Clark Brown, of Mohawk, N. Y.

A FRENCH savant, M. Regnard, has been lately trying the effect of a "blood diet" on lambs. Three lambs, which for some unexplained cause had been abandoned by their mothers, were fed on "powdered blood" with the most gratifying results. The lambs increased in size in the most marvelous fashion, and attained unusual proportions for their age. The coats of wool also became double in thickness. Encouraged by his success with the lambs, M. Regnard is now feeding some calves on blood.

Electrical Fire Batteries.

Dr. Brard, of La Rochelle, the inventor of the electro-generative fuel which we recently described, has communicated a paper to the French Academy of Sciences on this new method of producing electricity. The origin of the fuel is to be found in the discovery of A. C. Becquerel, in 1855, that red hot gas carbon plunged into fused nitrate of potash gave a considerable current through a galvanometer. M. Jablochkoff afterward endeavored to devise a battery based upon the fact in question; but nothing practical appears to have come of his intentions. Dr. Brard has at least attained some practical results, and also some theoretical observations of value. He finds that if any carbon whatever be plunged red hot into a bath of liquid nitrate brought to a red heat, we get an energetic current flowing from the bath to the carbon in the external circuit. Hard carbon, like that used by Becquerel, and graphite, yield the current, which, however, soon falls off, owing to a dense crust of the salts forming on its surface. Softer carbons gives a longer current. Dr. Brard also finds that nitrates in fusion become very fluid, and acquire the property of moistening the body immersed in them, as an oil does. The capillary property of the nitrate allows of a current being got by heating the end of the carbon not immersed, provided the carbon is not too long. Moreover, it is not essential that the nitrate should be in contact with the carbon. It may be contained in a metal capsule placed upon the red hot carbon, and the current will flow as before. This is owing to a connection between the nitrate and carbon being set up by a film of nitrate stealing over the sides of the capsule. A useful battery is made by covering the capsule with asbestos cloth, then a coating of lamp black, and plates of metal over the black. The latter serve for the negative and the capsule of the positive pole of the element. Placed over a Bunsen burner a couple thus made gives, when the nitrate is in fusion, a constant current of from 6 to 7 milleamperes. It should be situated as near the point of flame as possible, where the hot smoke is given off. This soot takes the part of the hot carbon rod in Becquerel's experiment. The nitrates melt at 200 deg. C., but do not decompose except at 1,000 deg. C., or 1,200 deg. C. They appear to prevent oxidation of the metals or at least retard it considerably.

Proposed Triple Hulled Ocean Steamer.

Captain William Coffin, of London, who built the first large screw steamer which crossed the ocean, has designed a new style of steamer, models of which are exhibited at the office of Mr. James Alexander in the Mason building, Boston.

These models show a compound ship, composed of three ship hulls united as one vessel, the two outer hulls being longer than the central hull, and the whole being decked over. The outer hulls are of narrow beam and of equal length, and a hull much shorter is placed in the center space between the two longer vessels. The three hulls are rigidly connected by iron or steel bulkheads, box-girders, iron or steel decks or frames, in such a way as to form complete platforms or decks, and so as to leave considerable extra spaces between the ships. The center ship is to carry the engines, and is provided with a propeller at each end. All three hulls are tapered from the center, both vertically and longitudinally, and come to a rounded point at both ends, so as to enter the wave and reduce the pitching motion to a minimum, the rolling motion being done away with by the extent of water-spaces between the ships. The platforms or decks extend to about three-fifths (more or less) of the whole length of the outside ships in the center, and the remaining portion of the ends, forward and aft, are covered over for passing through the waves; but the space between is not decked over.

In ships of this construction for smooth water or river purposes the decks may be carried the entire length of the outside ships nearly horizontal, and in these cases the vessel may be propelled by either a screw or paddle wheels. Stability, safety, and speed are claimed for vessels so constructed.

The design has been approved by eminent naval men.

Captain Harrison Loring, of South Boston, has offered to build an experimental harbor excursion steamer for the net cost or workmanship and materials. The indications now are that the steamer will be built and put in service next summer.—*Boston Globe.*

Vermont Marble.

The marble industry of Vermont has been greatly extended during the past ten or twelve years. The aggregate product of the various quarries of the State during the year just ended was not far from 1,000,000 cubic feet, valued at $2,000,000. The number of men employed in the quarries and mills exceeds 2,300, and it required 10,000 cars to carry the marble away. Nearly $1,000,000 was paid for the labor of workingmen by the quarry owners.

A Large Excavator.

The Northern Pacific Railroad Company are using an excavator capable of handling from 100 to 1,500 cubic yards of earth a day. It is worked by two 40-horse power hoisting engines, two 20-horse-power swinging engines, and a double rotary engine for forcing the scoop into the bank. The excavator is self-propelling, and when in working condition is 50 feet long, 10 feet wide, and 19 feet high.

The Washington Monument.

The annual report of Lieut. Col. Thomas L. Casey, Corps of Engineers, United States Army, engineer in charge of the Washington Monument, submitted to Congress Dec. 23, shows that the height of the shaft is now 340 feet, an increase during the year of 90 feet.

Since the completion of the foundation in 1880, the total load added to the then existing structure has been 28,355 tons, and the settlement of the shaft due to this load has been on an average about 1¼ inches for the structure. The total pressure now borne by the bed of foundation is 74,871 tons, or about 92-100 of the total pressure to be finally placed upon it. The amount expended on the monument during the past year was $177,849.60, leaving a balance available of $33,417.37. An estimate of $250,000 is submitted for continuing the work of the monument for the year ending June 30, 1884, which it is expected will complete the shaft and pyramidion, and also the interior staircase and elevator. The report is accompanied by a letter from the Joint Commission recommending an appropriation by the present Congress of the amount estimated as necessary to complete the monument to its full height of 555 feet.

Railway Building in 1882.

The *Railway Age* of Dec. 28 contains a table showing that the number of miles of main track laid in the United States during the past year was 10,821, on 316 lines, in thirty-four States and Territories. It is thought that full returns will raise the total to 11,000 miles, which is 1,500 miles more than the total for 1881. The States showing the largest amount of railway construction are:

Iowa, 953; Texas, 817; New York, 752; Ohio, 555; Arkansas, 529; Indiana, 529; Colorado, 500; Dakota Territory, 480; Pennsylvania, 464; and Minnesota, 444. Of the 316 roads noted, 140 are still incompleted. The capital invested during the year is estimated at $270,000,000, exclusive of the amounts expended in the preparation of the roadbeds on which tracks are not yet laid.

The Largest Railroad.

The Pennsylvania system, of which Mr. G. B. Roberts is president, still leads the country, 6,438 miles—and of course the world—although it is composed of several subordinate systems, each with its general officers. The Missouri Pacific system, of which Mr. Jay Gould is president, is also composed of several distinct roads and corporations—the Missouri Pacific, St. Louis, Iron Mountain and Northern, International and Great Northern, Texas and Pacific, etc., though with one set of general officers. Coming down to a single corporate organization under one title, with one list of officers for the whole system, the Chicago, Milwaukee, and St. Paul takes the lead with its 4,500 miles, though several other companies are close behind.

How to Stop the Sulphuric Acid.

Knowledge says that Dr. Jule has been experimenting, with a view to counteracting the bad effects produced by the sulphuric acid, which the combustion of ordinary illuminating gas causes in sufficient quantities to destroy the binding of books and to tarnish the lettering on their backs, besides, of course, vitiating the atmosphere so much that the health of the person breathing it is injured. He suspended two plates of finely perforated zinc, one three and the other twelve inches above the burner. At the end of three months the lower plate showed an accumulation of the ordinary brownish-black deposit and a furring of sulphate of zinc, but the upper plate was only slightly affected. The inference from this examination is that a single plate of perforated zinc, about a foot square, placed over a gas jet is sufficient to retain most of the noxious emanations.

"Corn" Coal.

The smallest sized anthracite coal hitherto produced has been the "buckwheat" size, much used as an economical fuel for small establishments requiring but little steam. A still smaller size, "corn" coal, is now produced by the Ebervale colliery. The manner of its preparation is thus described by the Hazleton (Pa.) *Sentinel:*

Every particle of culm that formerly was dumped on the bank as worthless after the buckwheat coal had been screened is now run into a screen with meshes about one eighth of an inch square. This screen revolves rapidly, and a powerful stream of water is forced into it, which washes out the fine dust into the water troughs and allows the coal to drop into a chute. It is then dumped on a bank, where it remains in stock until sold. It brings from $1.25 to $1.50 per ton. The Ebervale Company by this method are able to prepare about 25 tons of corn coal in addition to the usual quantity of buckwheat and other sizes for every 500 tons of coal hoisted from the mines.

Increasing Use of Tin Plate.

The importation of tin plates into this country has increased in a remarkable degree within the last few years. The imports in 1870 were 1,507,000 boxes; in 1875, 1,920,000 boxes; in 1876, 1,800,000 boxes; 1877, 2,140,000 boxes; 1878, 2,160,000 boxes; 1879, 3,120,000 boxes; 1880, 3,380,000 boxes; and in 1881, 3,600,000 boxes. There are about 20 boxes of common tin plate to the ton. Two of the chief causes of the increased demand for tin in the United States are found in the enormous canning industry and the growth of the tin-roofing business.

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ENGINEERING INVENTIONS.

Mr. John H. Darragh, of San Francisco, Cal., has patented an improved rotary engine possessing certain novel features which cannot be clearly described without the aid of engravings.

Mr. Daniel E. Kelley, of Gaylord, Kan., has patented an improvement in car couplings, consisting in the employment of mechanism for operating or elevating the coupling pin, and for guiding the link into the approaching drawhead.

Mr. Lewis I. Hinkle, of Piedmont, Mo., has patented an improvement in the class of car couplings in which the drawheads are provided with a fixed horn or pin that projects upward from the front end thereof, and with which the link may engage automatically.

Mr. George H. Whitman, of Eureka Springs, Ark., has invented an improved boiler feeder. The object of the invention is to provide a feeder which shall act automatically to retain the water at a uniform height. It consists in a revolving feeder operated by the water and steam pressure to pass the water to the supply pipe.

An improved car coupling has been patented by Mr. Francis Griffin, of Greenville, Miss. The invention consists in a drawhead provided with a transverse pintle, on one end of which a hook plate is pivoted, the other end projecting from the side of the drawbead and forming a catch for the hook plate of the opposite drawhead.

Mr. George K. Hoff, of Philadelphia, Pa., has patented a car coupling formed of two drawheads, each made with a bevel ended projection upon one side of its end, a socket in the other side of its end, and a curved notch partly in its end and partly in the base of the projection, whereby the two drawheads can be locked together by a coupling pin.

An improved car coupler has been patented by Mr. John A. Miller, of Wadesville, Ind. The object of this invention is to avoid the necessity of the operator passing between the cars at the time of coupling, and the invention consists in coupling hooks hung to the drawheads by ball and socket joints, provided with levers for their operation from the top of the cars, or at one side from the ground.

The following car coupling improvement has been patented by Mr. S. Lewis Holmes, of Hillsborough, O. This invention consists of devices to hold up the coupling pin so that the link will enter, and then trip the pin from either side of the car and let it fall and secure the link; also a link lifting device whereby the link can be lifted up to enter and couple from the sides of the car. These improvements are applicable with slight alteration of form to the drawbars of any form in use.

An improved locomotive head light has been patented by Mr. Frank H. Talbot, of Rochester, N. Y. The invention consists in a certain arrangement and construction of transparencies and the frames which carry them, for indicating at the sides of the head light by the direct rays of the lamp the number of the train, the number of the section of the train, and the number of the locomotive drawing it, or other like information useful or necessary in the running of a railroad, each of the transparencies being separate, with provision for the removal of them or certain of them as required.

John Fenimore, of Orleans, Ind., has patented an improved automatic car coupler. The invention is calculated to facilitate car coupling and to remove the danger attendant upon this operation. It consists in the employment, in connection with a drawbar, of spring plates adapted to slide therein with their outer ends projecting beyond the forward end of the draw bar, and having apertures through them to register, with a transverse horizontal passage through the drawbar and a spring coupling plate or bar adapted to pass through the passage in the draw bar and the apertures in the aforesaid spring plates and having an operating lever.

Mr. James P. Davison, of St. John, Ill., has patented an improved car coupling. The invention consists in a drawhead provided with a swinging spring latch partially crossing the end opening of the drawhead from above, and in a spring hook latch partially crossing the drawhead opening from below, which lower spring latch is provided at its rear end with a tapering projection fitting into a notch in a disk mounted on a transverse shaft, which disk is provided opposite the notch with a segmental recess, into which a second disk passes, which is mounted on a transverse shaft provided with a handle, whereby the hook latch will be locked in position and cannot be lowered until the said handle is turned, whereby the disks will be turned, and will permit a movement of this lower hook latch.

MECHANICAL INVENTIONS.

An improved window sash has been patented by Mr. William Heaps, of Walden, N. Y. The object of the invention is to provide a window sash which may be easily raised or lowered and locked securely in any desired position without the use of weights, cords, locks, or latches.

A patent has been obtained by Mr. Charles M. Dexter, of Sacramento, Cal., for a new and useful improvement in tuck folders for sewing machines. It consists in the peculiar construction of the tuck fold, and the object sought for is to facilitate the correct, rapid, and easy formation of tucks or plaits in cloth.

Mr. Oscar Rust, of St. Joseph, Mo., has patented a well-drilling machine in which the drill rod is operated by an oscillating lever connected thereto by a rope. The invention consists in certain improvements relating to the construction of the mast and the arrangement of the lever and its operating mechanism with respect to each other, together with other minor improvements.

A novel mechanical fan has been patented by Mr. Darwin S. Wright, of Macon, Ga. This invention relates to devices for communicating power to a fan, or a number of fans, for the purpose of cooling the atmosphere in houses. It has for its object to provide a construction which shall be variously adjustable, in order that the fans may be arranged in different positions, according to convenience.

An improved bag filling apparatus has been patented by Mr. Charles L. Kelley, of New Vienna, O. The invention consists of a hopper so arranged upon a table that it may be raised and lowered at convenience. Attached to the opening at the bottom of the hopper is a funnel section consisting of two parts pivoted together in such a manner that they may be adjusted to any size and rendered capable of entering the smallest bags.

Mr. Arthur Felber, of Louisville, Ky., has patented a new and improved stop motion for button hole sewing machines. This invention consists of an arrangement of automatic stop mechanism for button hole sewing machines, whereby after setting a machine in motion the operator may turn his attention to another machine for setting that in motion, leaving the first to stop itself when the button hole is completed. This enables one operator to run two machines at the same time.

An improved car unloader has been patented by Mr. George W. Rolph, of Toledo, O. This invention consists of the details of construction of certain parts of a car unloader for discharging earth from flat cars over the side by means of a kind of scraper, to be operated by power from the locomotive drawing it along against guide rail. located upon one side of the car to scrape off the load on the other side of the car, the said scraper being drawn along the train from one car to another.

Mr. Charles W. Jones, of Lowell, Mass., has patented an improved carpet stretcher. The invention consists in a carpet stretcher of novel construction, which not only provides for stretching the carpet, but for holding it while being tacked to the floor. It also comprises a novel anchoring device and a swiveling stretching head capable of being set at different angles, to work in jogs or curved spaces of a room and in narrow places, the whole forming a light, simple, and durable device which may readily be operated by a single person.

Mr. William Klostermann, of Cologne, Minn., has patented an improvement in middlings purifiers. The invention consists in the combination of an inclined rotary drum provided with elevator strips on its inner surface, and a vibrating middlings distributer arranged therein; also in the combination, with a vibrating middlings distributer and an elevator drum surrounding it, of devices for creating a current of air in the distributer. The invention has other points of novelty which cannot be clearly described without engravings.

Mr. Walter P. Prall, of Colusa, Cal., has obtained a patent for an improved sulky hay rake. The invention belongs to that general class of hay rakes in which the draught attachment is made to co-operate with a lever in raising and dumping the rake, and the special improvement consists in the novel arrangement and combination of a certain jointed bar and lever in connection with the rake head and draught whereby the rake is unloaded and otherwise controlled, and also for the improvement made whereby more room is obtained for the collected hay, thus avoiding the upward pressure which causes the teeth to rise and pass over the hay without performing their intended work.

Mr. Edward Rowland, of Tiffin, O., has patented a new and improved seal lock. The invention relates to seal locks for car doors, and other analogous applications designed to prevent the surreptitious opening of the door. It is an improvement upon that class of seal locks in which the bolt section enters a chamber and is there retained by a spring catch, access to which spring catch is prevented by a glass plate which has to be broken before the spring catch can be removed to withdraw the bolt. The invention consists in the peculiar construction and arrangement of parts, and in the means of detecting the surreptitious breaking of the seal plate.

Messrs. George I. Blackley and John I. Nicholson, of Greenville, Tex., have patented an improvement in that class of couplings in which a vertically moving pin is employed in connection with a link of ordinary construction for the purpose of securing the cars together. It consists mainly in the combination, with a pin of special construction, having attached thereto a spring adapted to give it its downward movement, of a pivoted frame adapted to hold the pin in its elevated position against the action of the spring until the cars come together, and then to release the same in order that the coupling may be effected,

An improvement in car couplings has been patented by Mr. William L. Skelton, of Jacksonville, Ala. This invention is designed to effect the automatic coupling of the cars and to enable their ready uncoupling. This car coupling has an approximately triangular shaped coupling pin having a weighted lower end and an upward extension; the forward edge of the lower end rests in a notch or recess in the bottom of the opening of the drawhead. A crank lever is pivoted to the end of the car, and has one end resting against the upward extension of the pin, and its other end connected to a rod reaching to the top of the car. By means of this rod the coupling pin is operated.

A new stop motion for spoolers, twisters, and doublers has been patented by Mr. Alexander G. Brown, of Williamstown, Mass. The invention consists in the combination, with a rotating spool carrying spindle provided with a transverse rod or bar, of as many pivoted check levers as there are threads to be wound on the spool, which check levers are each provided with a loop through which a thread passes, whereby, when the threads are unbroken, the check levers will be raised, permitting of a rotation of the spindle; but when a thread breaks the corresponding check lever drops, the transverse rod of the spindle strikes against the end of this check lever, and the spindle will be stopped immediately.

In carding machines where two, three, or more machines are arranged in one set, each of which works separately and independently of the other, and unlike the English or longcarding machines, where more than one are combined, a continuous even feeding from one engine to another is required in order to obtain good results. To accomplish this is the object of an invention patented by Mr. Ernst Gessner, of Aue, Saxony, Germany. By the use of this improved machine an even and broad flat sliver of any breadth of the material carded in one engine is formed, and, carrying it to the next, deposit it upon the feed table and feed it to the licker-in of that engine, forming a constant connection and transfer of wool from one machine to the other, and laying the sliver upon the feed table of the second machine in such manner as to secure an even thickness of material from side to side of the feed table without ragged edges.

AGRICULTURAL INVENTIONS.

Mr. William N. Smith, of Brookfield, Mich., has patented an improved separator for separating grain from chaff, and for cleaning all kinds of grains and seeds. The invention consists in a novel arrangement of a hulling cylinder and shakers of peculiar construction, which effect a thorough separation of the grain from the chaff.

Mr. Ezra Peak, of Westfield, O., has patented an improvement in wheel plows consisting in the combination of an axle having a crank extending rearwardly, a yoke extending vertically over the axle, a plow frame adjustably suspended from the axle, and the yoke and plow adjustably suspended from the frame.

An improvement in harrows has been patented by Mr. Laurens S. Wheeler, of Independence, Kan. This invention relates to harrows of two or more sections connected to work together as one, but having the advantage of adaptability to the uneven surface of the ground, which a single construction does not possess.

Mr. Harrison C. Lott, of Lexington, Ill., has patented an improved grain separator. The invention consists substantially of a grain separator constructed with a thrashing cylinder, a straw shaker, a separating table, a crank shaft, a shoe for receiving the grain when separated, a fan blower for removing the chaff, driving pulleys and belt. The invention consists in the adjustment of these parts one to another, in such a manner as to facilitate to the greatest extent the separation of the grain from the straw and chaff.

MISCELLANEOUS INVENTIONS.

Mr. David J. Taylor, of Grinnell, Ia., has patented an improved dress chart for facilitating the draughting, cutting, and fitting of ladies' and children's garments.

An improvement in harness pads has been patented by Mr. Edward P. Waters, of Roseville, Ill. The invention consists in the combination, with the skirts and pad, of a loop piece through which the skirt passes, and by which it is held in place.

An improved heater for dwelling houses has been patented by Mr. James B. Harris, Jr., of Geneseo, N. Y. This heater is especially adapted for use in some room in a house, as it will heat the room it may be placed in and also by steam pipes all the other rooms of the house.

Mr. John W. Wolcott, of Clyde, O., has invented an improved railroad time bulletin board. This relates to that class of bulletin boards which are provided with means for changing announcements as occasion requires. The invention consists in the peculiar construction and arrangement of parts.

Mr. Robert A. Carter, of Elizabeth, N. J., has patented a novel and interesting improvement in the manufacture of frames for eye glasses. The distinctive novelty of this invention lies in the construction of the metallic connections of spectacles, eye glasses, etc., by means of a turning process.

Mr. William M. Boyd, of Rushville, Ind., has patented an improved sulky provided with a tongue for hitching two horses thereto. It has a foot rack which is independent of the frame of the sulky, so that, together with a lever contrivance, the springs may be relieved to some extent of the weight when overloaded.

A patent has been obtained by Mr. Timothy W. Murphy, of Washington, D. C., for a new and improved horseshoe. The invention consists of a horseshoe with dovetailed and shouldered recesses for receiving calks of corresponding construction, and in securing the calks in position by means of screws having their heads countersunk in the shoe.

Mr. Charles A. Cooley, of New Britain, Conn., has patented an improvement in that class of electric arc lamps in which some of the exposed parts are insulated from the current. In this lamp accidental contact of a conducting substance with any portion of the lamp or frame will result in no diversion of the current operating the lamp.

Mr. Charles A. Cook, of New York city, has patented an improved drop handle for drawers, etc., which is of simple construction and can be manufactured at a low cost. The invention consists in a drop handle formed of a handle knob provided at its upper end with a U-shaped clip, which is pivoted to a U-shaped clip held in a cap on the front of the drawer.

An improved belt stretcher has been patented by Mr. Zarda Frost, of Kinmundy, Ill. This invention consists in a tool having a hook ended blade and provided with pivoted arms shaped to hold the buckle or the end of the belt. By means of this arrangement the two ends of the belt may be readily united.

A combined button lap and stay for garments has been patented by Mr. David W. Thompson, of Englewood, Ill. This invention relates to a combined button lap and stay for the openings in garments, such as the openings at the neck or sleeves of shirts, the openings in the front or sides of drawers and overalls, or for plackets, pockets, or other similar openings.

Mr. Jens H. Christiansen, of Mones Island, N. J. (P. O., Chester, Pa.), has patented a process of treating stalks and leaves of certain fiber producing plants, which consists in hackling or combing them into strips, boiling the latter in an alkaline bath, next removing the gluten, and immersing the fiber thus obtained in a bath of boracic acid, soap, and glycerine.

An improved egg carrier for use in transportation has been patented by Mr. Charles D. Lewis, of Georgetown, Col. The invention consists of an elastic packing case, provided with a stall for each egg rigidly secured at its corners and to the bottom, forming one piece throughout. The sides and bottom of the partition are furnished with holes for purposes of ventilation and to lighten the carrier.

A new and improved combined pole tip and neck yoke clamp has been patented by Messrs. Francis W. Sibert and Stephen P. Hurd, of San Antonio, Tex., This invention consists in a combined wagon pole tip or socket and neck yoke clamp, which can be easily attached to and detached from the pole or neck yoke, and which, when in use, will be self-adjusting to the movements of the neck yoke due to the motion of the team.

An improved punch for marking cattle has been patented by Mr. August Tigniere, of Wichita, Kan. This instrument is composed of a pair of jaws operated after the manner of a punch, and a novel combination with the instrument of a series of removable dies for cutting letters or figures, whereby provision is made for using the same instrument for marking different characters.

Mr. Henry Bell, of Baltimore, Md., has patented an improvement in filtering funnels which are provided with vent tubes. The invention consists in the novel construction of the funnel and combination therewith of a vent tube. This funnel has an annular projection around the brim, on which is placed an elastic band to protect the funnel against breaking by contact with other things.

Mr. Eugene W. Humphreys, of Salisbury, Md., is the inventor of an improved fruit basket for which he has obtained a patent. It relates to that class of fruit baskets or boxes which are made of veneer or thin sheets of wood cut and creased so as to be folded to constitute a basket adapted to hold berries or other small fruit, which baskets are designed to hold a definite quantity of fruit and be packed in crates for shipment.

Mr. Kasson Freeman, of Grand Rapids, Mich., has patented an improved surveying instrument, the object of which is to dispense entirely with the services of the chain and chainmen. The invention consists in the employment of a compass or transit instrument provided with a micrometer sight and a cross, and with a registering table having micrometer sights and a staff detachably secured to a tripod, whereby the employment of a chain becomes unnecessary.

Mr. Edward T. Wolcott, of Kenosha, Wis., has patented an improved and novel wire mattress which is designed to prevent the bed from sagging in the center. The invention consists in elastic supporting springs stretched diagonally across the mattress frame from corner to corner immediately under the mattress, so as to provide an extra amount of strength at the center of the mattress at the point where the greatest weight rests.

An improved chemical fire extinguisher has been patented by Mr. Daniel Parham, of Tyngsborough, Mass. This invention consists of a gas supply and distributing apparatus in which weights suspended or supported by cords of combustible material are adapted, when the cords are burned, to fall and act upon certain parts of the apparatus to generate and distribute the gas to the locality of the fire for the purpose of extinguishing it.

Mr. Franklin Pierce, of New York city, has patented a hod elevator constructed with a frame having a vertically moving crossbar, provided with hod-receiving hooks and supported upon eccentrics, whereby the hods can be lowered to bring their handles into contact with the elevator platform and free the hods from their supporting hooks. To the lower part of the main frame is attached an auxiliary frame, to keep the hod handles in nearly a vertical position while the hods are being elevated.

An improvement in making boxes and baskets has been patented by Mr. John Howenstine, of Chattanooga, Tenn. The object of this invention is to facilitate the manufacture of boxes, fruit baskets, measures, and like articles which are made of sheets of wood, pasteboard, leather, metal, or other suitable material. The invention consists in a folding box made of a folding side blank provided at the ends with hook lugs, which, when the box is completed, pass into apertures in a bottom blank, which is passed within the folded side blank from the bottom.

An improved tobacco drier has been patented by Mr. James H. Fizer, of Millersburg, Ky. This invention relates to an arrangement of heaters, whereby the room for hanging tobacco to dry in the barn is economized; and it consists in arranging the heaters at about equal distances on the barn floor and running the pipes in couples direct from the heaters to chimney pipes in the sides of the barn, said chimney pipes extending above the roof of the barn at some distance from its side to insure safety fire. This is an important feature, as many farmers know by experience. This improvement permits the sweating to be done in cool weather. The steam softens the air and effects the sweating in a short time, so that the tobacco thus treated is equal to one-year tobacco. The tobacco treated by this process is always sweet.

An improvement in upholstered chairs, sofas, etc., has been patented by Mr. William E Buser, of Chillicothe, O. The invention consists in providing a chair or other frame with an upholstering frame, which is secured inside the frame in such manner as to form an offset or projection therefrom, and stretching the upholstering fabric over said inside frame, in direct contact therewith and securing it in said position, whereby the upholstered work shall be supported in relief from the main frame within the margin formed by the exposed woodwork of the side bars without the use of moss, rolls of tow, rubber strips or other expedients commonly employed for building up the edges, the object being to provide an inexpensive article of furniture which shall have all the advantages of the more costly upholstered class.

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Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) E. S. asks: Could you inform me of some simple way to make a furnace capable of melting brass or copper, and what should be used for fuel? A. A small cylinder stove lined with fire brick makes a very good furnace for melting brass, and will also melt copper if you have a good draught. If your wants are small, you may easily find a second-hand stove of sheet iron with a lining already in that will answer your purpose. Use ordinary anthracite coal of good quality. Do not have a crucible of more than one-third the diameter of the inside of the stove. Build the fire as in any stove, and set the crucible in, filling coal all round it. Use a pair of tongs with the ends bent sidewise, so as to handle the crucible easily.

(2) A. B. C asks whether it is scientifically true that there is an *equinoctial* storm. A. It is customary to call any general storm occurring any time within a month of the equinoctial passage an "equinoctial." It is only accidentally coincident with the sun's crossing of the "line." Sometimes the season passes without an "equinoctial."

(3) M. G. F. asks: Can you inform me of the ingredients and the process for making soda water, so extensively used as a summer drink? A. Soda water, so called, is a solution of carbonic acid gas under pressure in water. The gas is evolved from a mixture of marble dust and oil of vitriol in a peculiar apparatus for the purpose. For the sirups used in flavoring this soda water, see SUPPLEMENT No. 77.

(4) M. E. W. writes: I have a telescope with a 1⅝ achromatic object glass, focus about 25 to 30 inches, with celestial eye-piece, power 146 times. In using it for star gazing, they look upside down. Could I attach a terrestrial eye-piece to remedy this? and could I see Jupiter's moons and Saturn's rings with the telescope, if I used a terrestrial eye-piece? If so, please let me know the size and power of eye-piece I would need, and if I could attach it to the one I have? A. If your telescope of 25-inch to 30-inch focus bears a power of 146 times, you ought not to complain of the objects being upside down, as all astronomers see them in that position, and get used to it. A terrestrial eye-piece will only magnify from 20 to 40 times in your telescope. You could, of course, have one fitted to your telescope which would do excellent work on terrestrial objects, but would lack brilliancy and power on celestial objects; would show Jupiter's satellites, but would not give satisfaction with Saturn.

(5) L. D. A. asks: 1. What height can water be raised with a siphon above its level? A. Safely about 18 or 20 feet. 2. Can I raise water 25 feet with 3 feet fall with a hydraulic ram, and are they durable? A. Yes, if you have plenty of water to work the ram, but the quantity raised will be not more than one-tenth or one-twelfth of that used in the ram.

(6) O. H. G. asks: Of what material should the reservoirs for the acetate of soda stoves be made? Will tin or sheet copper do, or must it be something stronger? A. Galvanized iron will answer best.

(7) M. O. asks: 1. For a cheap and practical method for preserving flowers. The flowers I would like to preserve are tulips, hyacinths, and crocus. How long will these preserved flowers last? A. Dip them in a concentrated solution of arseniate of soda. It is very poisonous, and care must be used in employing it. 2. How to polish some black walnut boards. A. Use pure linseed oil, to which may be added five to ten per cent of fine shellac varnish. Rub on with a cloth until the polish is obtained.

(8) J. W. B. writes: 1. I would like to know how to make good moulds to cast small articles for the trade, such as broom hangers, and small novelties generally. I have tried the alloy mentioned in SUPPLEMENT No. 17, of antimony 1 part and tin 4 parts; but the antimony did not mix with the tin, and is too malleable for my use. The antimony that I used was a black powder. Was it right, and what was the cause of my failure? A. You probably used an ore of antimony; the sulphuret pulverized would be a black powder. Metallic antimony is a hard brittle shining metal and almost white, and makes a fine alloy with tin for your purpose. You may have to send to Philadelphia or New York for the metal. 2. How can I solder the ends of two wires together to make a good smooth joint? A. Scarf your wires and tin them together with a copper soldering iron. If you want a very strong joint, use silver solder, with borax as a flux. You will require a blowpipe flame for this.

(9) W. S. P. writes: 1. Suppose a steam pipe, say 3 inches diameter, should have iron cast upon its end, so as to close the end and come up on the pipe say 1¼ inch—the pipe having a thread cut or being battered so as to give a hold to the casting—would the pipe leak steam at, say 100 to 125 pounds pressure? If not, would the joint be durable? A. The chance of making a tight joint would not pay for the trouble—it is very uncertain, and entirely ignored by those who make such joints as a business. Cut the threads and screw the caps on. 2. I wish to carry wheat from one bin to another, distant about twenty yards, bringing from first bin to fan mill on about same level, then to second bin, about six or eight feet higher. I want to do this by pneumatic process, for the whole affair must be very light and portable, suitable for one or two horse power, and able to handle two tons per hour, and adjustable to different situations. I do not know what kind or size of fan would be proper, or whether the bin must act by *suction* altogether, or will a blast entering pipe at same place and distance as the grain do as well? In case of using suction, how is the grain at delivery end prevented from entering fan? A. Your plan for transferring grain by pneumatic blast or suction is not feasible to any extent, except for the purpose of cleaning the grain. One to two horse power will not do work with a fan worth considering.

(10) W. J. W. asks: Is it possible for a human being to be suspended in the air without some mechanical or electrical aid. I claim that it cannot be done merely by one person having some mesmeric or other influence over another. A. You are correct. There are various agencies, mechanical and others, whereby a human being might be suspended in the air without visible attachments or connections with any adjacent object. No known "mesmeric" influence will do the business.

(11) C. G. asks how muriatic acid is produced. A. What is known as muriatic acid consists of a solution of water and hydrochloric acid gas, which latter has a strong natural affinity for water. Hydrochloric acid gas is made by mixing common salt and sulphuric acid, and heating the mixture. The resulting gas is brought into contact with water, which absorbs the gas with remarkable avidity. One pint of water, it is said, will absorb four hundred and eighty pints of hydrochloric acid gas, the resulting mixture forming 1⅔ pints of what is called muriatic acid.

(12) E. L. C. writes: I have this fall put in a hydraulic ram, which works under 16 feet head and throws water 110 feet high. Now, when I first start the ram it works all right and throws up a good stream of water, but after a day or two the discharge grows smaller, and about the seventh day stops. The ram keeps at work the same all the time, and the only way that I can start it is to take the ram to pieces; but there seems to be nothing wrong except that the globe or air chamber is full of water. Is this the cause, and how can it be helped? A. The fault is in the air vessel losing its air. About eighteen inches from the air vessel drill an air hole, about one-eighth inch diameter, in the top of the supply pipe. This will keep the air vessel supplied.

(13) C. W. C. asks: What is the relative torsion of common iron shafting, machine steel, cast steel, compressed steel, cold rolled shafting? A. The relative torsional values of the various kinds are estimated as follows: Ordinary turned shafting equals 1; cold rolled shafting, 1·10; machinery steel shafting, 2; cast steel shafting, 3. We know of no tests of compressed steel.

(14) L. C. V. writes: 1. I have a small model engine, 1½ inches bore, 3 inches stroke. What size boiler do I need, running engine at 300 revolutions per minute, steam pressure 40 to 50 pounds? A. A boiler with about 40 feet fire surface, if tubular. 2. Will not copper make a better boiler than common wrought iron, and is one-eighth inch thick enough for perfect safety? A. Not so strong as iron. One-eighth inch, if of iron, is thick enough, if no more than 16 inches diameter. 3. In making a copper boiler, which is best, riveting or brazing? If rivets, what size is best? A. Riveting; diameter of rivets, five-sixteenths inch. 4. What will be the power of the above engine; it is perfectly made and new? A. A little over two horse power. 5. Where can I get directions for making a cheap telephone, working distance, 300 yards? A. See SUPPLEMENT, No. 142.

(15) G. C. A. asks: Is there any form of electric light in which there are two parallel carbons separated by plaster of Paris only? If so, what is the mechanism? What is the method employed of electric street lighting in Paris, France? A. The Jablochkoff electric candle is made in the manner described. It is used in connection with an alternating current machine It is used in Paris, and in other places.

(16) E. A. B. asks if coke burned in a Baxter furnace, two horse power, will be more liable to burn out iron sooner than coal or hickory wood. Coke is cheaper and more easily obtained, and is free from soot and smoke. A. It will not, unless burned with a very strong draught. It is less injurious than coal.

(17) A. G. asks: 1. Why does Dittmar powder, which is as strong as black powder, not give so loud a report as the black powder, and why does it give a long fire after being loaded in a shell for a couple of weeks? A. This is on account of the grain the powder possesses. The varieties of powder of this manufacture are so various that your mention is too indefinite. 2. Is there any book published that treats on gold, silver, and nickel plating? A. SCIENTIFIC AMERICAN SUPPLEMENT, No. 310, also "Galvanoplastic Manipulations," by A. A. Fesquet.

(18) T. F. writes: I am about to make four pricking wheels. Teeth apart, one 1 inch, one ⅞ inch, one ¾ inch, one ⅝ inch; would like to make them all one size—2 inches diameter. Can it be done? A. You cannot make the four pricking wheels of the same size. The following sizes are as near 2 inches diameter as possible:

For the 1 in., 6 teeth, 6 in. cir. ÷ 3·1416 = 1·909 in. dia.
" " ⅞ " 7 " 6⅛ " " ÷ 3·1416 = 1·949 " "
" " ¾ " 8 " 6 " " ÷ 3·1416 = 1·909 " "
" " ⅝ " 9 " 5⅝ " " ÷ 3·1416 = 1·772 " "
Or,
" ⅝ " 10 " 6¼ " " ÷ 3·1416 = 1·989 " "

(19) E. S. inquires on which of the two pulleys will a 1½-inch leather belt drive best, grain side next to pulley, a leather covered pulley or one covered with rubber, speed of belt 250 feet a minute. A. Your belt will drive best upon a pulley covered with rubber. From experiments, a leather covered pulley with leather belting is 50 per cent better than an iron pulley with the same stress; while a rubber covered pulley with same belt and stress showed 100 per cent gain over the leather covered pulley, and 250 per cent over the iron pulley.

(20) J. B. asks: In the Blake transmitter which is correct—for the current to go from the battery to primary of induction coil, thence to transmitter and return to battery, or from battery to transmitter, thence to primary of induction coil and return to battery; and with the receiver which is correct—from the line wire to the secondary of induction coil, thence to receiver and to ground, or from line wire to receiver and to secondary of induction coil, and to ground. Please let me know the correct way. A. In either case the manner of connecting up is of no consequence.

(21) T. S. asks: 1. Is celluloid, that so much used artificial ivory, a good insulator of electricity or not? A. Yes. 2. For connecting it firmly with metallic parts—say by screws or any other means—what will be the safest method to avoid its partial inflammation. A. We know of no way of doing this, as it will ignite if sufficiently heated.

(22) F. G. C. asks how to take the taint out of a galvanized iron can which has held kerosene. I want to use it for hot water. A. Rinse the can several times with benzine, allow it to dry out, then rinse it with alcohol.

(23) O. B. asks: 1. With a bichromate of potash battery of six one gallon cells, how can I produce an electric shock, and of what power? A. Use an induction coil. With a very large one you can destroy life. 2. Is there any electric motor and battery capable of producing one-half horse power; if so, what name? A. The Siemens or Gramme dynamo electric machine will produce any amount of power with sufficient battery, but we cannot advise the use of galvanic batteries as producers of power on a large scale. 3. Which is the best book on electricity for beginners? A. Begin with Ganot's "Physics."

(24) J. L. M. asks for a process for galvanizing iron. A. The process for galvanizing iron is as follows: Clean all scale, rust, and dirt or oil from the surfaces—if oily, by boiling in caustic soda—and then remove scale and rust by a bath of hydrochloric acid and water. If necessary, a little scrubbing with a metallic brush, and then thoroughly rinse in hot water and dry quickly. Then immerse in a bath of melted zinc; at the same time sprinkle a little powered sal ammoniac upon the surface of the melted zinc to clear it. Judgment is required as to length of time for the immersion, and temperature of the melted zinc—very small work is immersed but a few seconds.

(25) H. E. H.—Small wire can be welded without difficulty by heating in a muffled blowpipe with a groove in the bottom of the muffle, so as to retain a little borax. Butt the ends together with a gentle force while at a welding heat, at the same time upsetting a little, so that when you hammer or swage down you will not lose any stock by burning. We think that this will succeed better than scarfing.

(26) W. W. S. asks: 1. What is the cause of steam boiler explosions, or your theory of the cause, or the acknowledged scientific theory, if any? A. There are many causes. Each case must be closely investigated to determine the cause. 2. Did not the United States Government, several years ago, make an appropriation and appoint a committee of scientific gentlemen to inquire into this matter? If so, and I think they did, what were their conclusions or report? I do not recollect of ever hearing, but think I recollect of such an appropriation, etc. Did this committee recommend a preventive, or discover the cause? A. The operations of the commission were terminated in the midst of the work and no report was made, and they made no recommendation.

(27) J. T. B. writes: 1. We have a set of boilers that have been in use more or less for eleven years; they are clean and don't leak, and are apparently in good shape. How long should a set be run with good care, and how long before the plates in the fire box become crystallized and brittle and dangerous? A. Some boilers are run for twenty years (if well constructed). Their life depends upon the water used and care which they have had. You should have them carefully examined by a competent engineer. 2. Please tell me the difference between a high pressure boiler and a low pressure boiler, and the difference between a high pressure steam engine and a low pressure steam engine. A. A high pressure boiler is constructed of a strength to carry high steam and a low pressure for low steam—say below 40 or 50 pounds. A high pressure engine, as ordinarily understood, is one exhausting into the atmosphere and a low pressure one exhausting into a condenser. 3. In setting a boiler, what should be the distance or height between the grates and the boiler to give the best results? A. For coal, 30 to 36 inches; for wood, 3½ to 4½ feet.

(28) C. S. asks: If the inside of a copper vessel and a very narrow copper "goose neck" pipe can be enameled by an acid (sulphuric carbonic) and alkali (soda) proof enamel, and in what way? A. Try the following: Cullet, 11 pounds; boracic acid, 7 pounds; bicarb. soda, ¼ pound; phosphate of lime, 3½ pounds; oxide of antimony, ½ pound; finely powdered, mixed with water, and applied with a brush; finally fused on on when dry. Or the treatment detailed on page 3953, SUPPLEMENT 248, may be used, as it is acid proof also.

(29) L. H. T. asks: Is it possible that a shaft, 1¼ inch or 1½ inch diameter, or the steel arbors of a wood working planer cylinder, may be sprung or otherwise injured by pouring hot Babbitt metal on and around them in running the boxes in which they are to revolve? At about what heat should Babbitt metal be poured? A. It is a common practice in renewing or re-Babbitting boxes to use the journals for forming the moulds. The shaft will not spring perceptibly. If you paint the journal with a mixture of whiting and water and let it dry, the metal will run better. Pour with as little heat as will allow a full casting without cold sheets. Babbitt metal melts at about 600°.

(30) C. R. writes: 1. I have a desk on which, before I could varnish it, I spilt a large spot of ink. I would like to know how I can take it off without planing it or sandpapering. A. Use a solution of chloride of lime in vinegar. 2. Can I melt glass in a muffle furnace so it can be worked? A. Some soft American or German glasses may be fused in a muffle furnace.

(31) C. A. W. writes: The engine of my small tug boat, 5½ diameter by 9½ stroke, runs 3 to 1 of the paddle wheels. Could not friction wheels be used to connect in lieu of cogwheels, which cause great noise and vibration, and what sort and proportion? Paddle wheels 6·8 feet in diameter. A. Friction wheels would, no doubt, run without noise, but would take a little more power than gearing, because it requires some pressure upon their peripheries to maintain the required friction. The best grooved wheels, we think, are the multiple shallow grooves. If leather would not be out of place, we would suggest a broad thin leather belt, slightly rubbed with beeswax, and held close to the pulleys with a light tightening pulley. Two belts could be made to work together.

(32) W. E. F. asks: How much power can I get from an engine, 2 inch bore and 4 inch stroke, and what size boiler will I want to supply it with steam? A. You can obtain 1½ horse power by running, say 450 revolutions per minute. Boiler should have 38 to 46 feet heating surface.

(33) C. D. writes: We are using live steam in a kiln drier. The drier is placed 85 feet from a 10 x 20 engine, and we would like to know if we could use exhaust steam from the engine without cramping same by connecting exhaust pipe to both ends of the "header" inlet, which is a pipe 4 inches diameter, 11 feet long; and by opening both ends of the corresponding pipe for escape steam, this pipe being same length and size as above header; the two connected together by forty lengths of L-shaped pipes, 1 inch diameter, each being 22 feet long. Also would like to know what size pipe would be sufficient to connect engine with drier. A. You can exhaust through your drying coil without any difficulty. Connect the exhaust of the engine to the nearest end of the coil header with pipe of the proper size for the engine, so as not to materially effect the working of engine—say, for your engine, 2½ or 3 inch pitch. Also continue the same size pipe from the opposite end of the other header to wherever you wish to discharge the exhaust. Have a small drip (three-quarter inch) from the lowest part of header, so as to easily get rid of the water of condensation. You will not need double connections. You will get quite as much heat as from live steam by the difference between 212° and the temperature due to the pressure now used.

(34) J. H. R. asks: What is the difference in the durability and strength of malleable and common cast iron; also the difference in price of same; also how malleable iron is made? A. The difference in durability between malleable and cast iron depends entirely upon the manner of its use. For mere abrasion the cast iron is fully as durable as malleable; but for light pieces where there is much strain, as in harness trimmings and the like, malleable iron is preferable. The price of cast iron castings in New York is from 3 cents to 6 cents per pound, according to lightness. Some very light work costs as much as malleable. Malleable castings cost from 8 cents to 20 cents per pound, according to size and difficulty of moulding. Malleable iron is made by decarbonizing cast iron partly in a cupola by using low iron and reducing by burning out the carbon, and finally finishing the process after casting by annealing the castings inclosed in pulverized hematite iron ore or iron scales from a blacksmith's anvil.

(35) C. M. C. writes: 1. In the factory where I work they use the exhaust steam to warm the rooms, and would like to run the drip back to the water tank under the boiler and use the water in the boiler again. Will it cause the water to foam in the boiler? The engineer says it will. I cannot see how any oil can get into the boiler, as the tank is about four feet deep, and the water is pumped from the bottom and the oil would float on the surface of water. Please inform me through your paper what effect the oil would have on the water in the boiler if any should get in it, and how it can be used again. A. It will not foam to produce any injurious effect. Oil is sometimes introduced to stop foaming. By all means return the water to the boiler as a measure of economy. 2. Also, can you tell me of any way to treat glue so it will be elastic like gelatine copy pads, and be waterproof? A. Use glycerine, melting them together with a little water.

(36) J. P. asks if mountain or brook trout have scales. A. Very small scales.

(37) A. J. P. asks: Can water be drawn through a pipe 2 inches in diameter by a steam pump situated 3,500 feet from the reservoir, and about 20 feet above its level? A. Yes, if the pipe is tight, but the supply of water will, of course, be much less than if the pipe was but a few feet in length.

(38) L. J. asks: 1. How may I manufacture gas economically for blowpipe use? A. Gas cannot be manufactured economically on a small scale, and hydrogen is not safe. Use a Fletcher petroleum furnace jet or its equivalent with naphtha. 2. What is chlorinated lime, and how is it manufactured? A. Chloride of lime is manufactured by passing chlorine gas evolved from a mixture of hydrochloric acid and black oxide of manganese over lime held in trays as long as the latter will absorb it. 3. What is the centrifugal force of a 2-inch lead ball revolving around a 32-inch circle 60 times per minute? A. The centrifugal force of a 2-inch lead ball revolving in a 32-inch circle 60 times per minute is 2·83 pounds.

(39) J. H. S. wants information as to making and applying a wash for outhouses, fences, etc., to take the place of lime whitewash, but of some dark color—brown or stone color. A. Use melted pitch, or a mixture of lamp black, Venetian red, or similar pigment in spirits of turpentine, thickened with crude turpentine.

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(40) W. W. W. writes: Can I get any more heat from steam at 50 or 60 pounds pressure (for heating houses or factories) than at 5 or 10 pounds pressure? If so, what is the difference? A. You can get more heat at the high pressure by nearly the difference in temperatures of the steam at the two pressures. Temperature at 5 pounds pressure, 228°; at 10 pounds, 241°; at 50 pounds, 301°; at 60 pounds, 311°.

(41) J. B. asks for a good receipt for a preparation to keep water out of a coat. I am a fireman, and my coat is made of canvas; it is oiled and coated with some sort of black mixture, but whenever I go to a big fire the water goes through it. A. Try the following treatment: Soap, 2 ounces; glue, 4 ounces; water, 1 gallon. Dissolve the glue and soap in the water by heating. The cloth or garment is boiled in this for a quarter of an hour and then rinsed out and allowed to nearly dry; then it is allowed to lie in the following solution for six hours: Alum, 13 ounces; salt, 15 ounces; water, 1 gallon. After which it is wrung out, washed with water, and allowed to dry slowly, when it is ready for use. 2. Give a mixture to rub on boots that will keep out water and keep them soft. A. Use pure neatsfoot oil.

(42) J. W. asks for a simple and easy plan of procuring sample of water from bottom of a well 1,300 feet deep, 4½ inches in diameter. A. You may get a fair sample of water from a deep well by using the sand bucket, if you can make a leather valve on the upper end, and also make the bottom valve tight with a leather lining. Or, if you wish to make one, take a piece of iron pipe—say 2 inches—one or two feet long, screw a coupling upon one end, make a hard wood plug to screw into the coupling with a hole in it three-quarters of an inch diameter, and a soft leather clapper, loaded with a piece of iron or lead nailed upon the inside the same as a common pump bucket. At the other end of the pipe make a bale of one-quarter or three-eighths iron, and arrange a leather valve upon a block of iron, so as to fit tight upon the end of the pipe and have the bale as a guide. Let the bale have an eye for fastening a line, and also be heavy enough to carry down the line if you have a great depth of water to pass through. The bucket in descending will allow the water to pass through freely, but when you pull up the valves, close and confine the water. The bucket must not be allowed to have any motion backward during the whole ascent while in the water, or you will lose the charge and take a new one at the point of change.

(43) F. J. C. asks for information about the reversing gear on Maxim's steam launch Flirt. I would like to apply it to an engine of mine, about 2½ horse power, as I think it cheaper and as good as the regular reversing gear. A. The eccentric is fitted on a sleeve which works longitudinally on the shaft on a feather parallel with the shaft. On the outside diameter of this sleeve is a spiral feather fitting in a spiral groove in the eye of the eccentric. As the sleeve is moved back and forth, the eccentric is revolved to the extent necessary for the proper lead when working ahead or back.

(44) J. S. asks: 1. What is the area of a safety valve 4 inches in diameter, and how many square inches does it contain? A. 12·50 square inches. 2. A lever 28 inches long, the ball weighing 50 pounds—how many inches back on the lever must the ball be put so as to blow off at 50 pounds of steam? A. You do not give the distance from the fulcrum to the valve.

(45) S. C. writes: 1. I am running a steam pump; the size of steam cylinder, 8 inches bore; water cylinder, 2½ inches bore; 10 inches stroke; discharge pipe, 1¼ inches; suction pipe, 2½ inches. Could I draw water from a well 75 feet deep, providing my plunger, water valves, and pipe were all tight, having foot valve on suction pipe, if I were to first fill my suction pipe and pump full of water, having pressure of steam to move piston? A. No; you cannot "draw" water more than 20 or 30 feet if everything is perfectly tight. The pressure of the atmosphere limits the height. 2. What is the greatest number of feet that water can be lifted by suction with an ordinary steam pump? A. You would not be safe to attempt more than about 28 feet.

(46) F. S. asks: 1. In calculating the horse power of compound engines, how is the pressure in the large or low pressure cylinder obtained? A. The pressure is generally obtained from the indicator card. 2. What are the duties and pay of oilers on steam vessels? A. About $40 per month; sometimes less.

(47) T. D. M. asks: 1. What action would electricity have on a fur-bearing animal killed by it? A. None. 2. I would like to know about sulphurous acid gas in reference to the same purpose. A. Sulphurous acid gas would not injure the fur.

(48) J. A. asks: Where can I obtain the latest and best information on the reduction of silver ores? A. Obtain Percy's "Metallurgy of Gold and Silver" from the booksellers who advertise in our columns.

(49) C. E. B. writes: 1. You refer in issue of Nov. 18, 1882, page 329, of SCIENTIFIC AMERICAN, to ether spray as a cure for neuralgia in the face. Is it safe for an inexperienced person to apply? A. No. 2. How is it applied? A. By means of an atomizer.

(50) H. C. A. asks for a receipt for removing lard oil stains from linen table covers. A. Lard oil is soluble in 36 parts hot alcohol. White goods may be washed with soap or alkaline lyes.

(51) C. W. asks for a receipt for making the cement for putting gum soles on shoes. A. (1) Dissolve 10 parts of caoutchouc, in small pieces, in 280 parts of chloroform by maceration, melt 10 parts more of finely cut caoutchouc with 4 parts of resin; add 1 part turpentine, and dissolve the whole in 40 parts of oil of turpentine. Then mix the solutions. For use dip a piece of linen in the cement and apply it to the article, which should also receive a layer of the cement before and after the application of the linen. (2) A cement is made by dissolving india-rubber in carbon disulphide, chloroform, or benzine. Apply as above.

(52) W. H. R. asks how to wash or erase ink from paper, ledger books, etc? A. Writing may be erased by washing it with a solution of chloride of lime and acetic acid. In the SCIENTIFIC AMERICAN for November, 1881, pyrophosphate of soda is recommended. It is best to first apply tallow to the ink spot, then wash in a solution of pyrophosphate until both tallow and ink have disappeared. Solution of potassium oxalate is sometimes used.

(53) F. R. H. asks for a process for treating barytes with oil of vitriol and steam to purify it. A. Barytes may be prepared artificially for use as a pigment by adding dilute sulphuric acid to a solution of barium chloride, when a white precipitate is formed, this is washed and dried. Also, it may be prepared by heating the native mineral, grinding it to powder, and washing it, first in dilute sulphuric acid in order to remove any traces of iron, and afterward in water; the white powder is then thoroughly dried. Such is the process at Matlock Bath, Derbyshire, England.

(54) P. H. L. asks: 1. If a phosphorus lamp of any degree of light can be made by pouring boiling hot sweet oil into a bottle with a small piece of phosphorus in it, and then hermetically sealing. If so, how can I boil the oil? A. To make a phosphorus lamp or bottle dissolve 24 grains of phosphorus in an ounce of olive or cotton seed oil. The two should be mixed in a thin vial (flask), which should then be placed in hot water. When the phosphorus melts, cork the vial and shake vigorously until nearly cold. Upon being uncorked, it emits considerable light. This is a difficult and dangerous manipulation. 2. Give process for erasing or absorbing writing ink after it has become dried on the paper. And if it can be made in a solid form to use as a rubber eraser is used for leadpencil writing. A. For this purpose a solution of oxalic acid may be used, into which the paper is dipped and then allowed to dry quickly. While the paper should be saturated with this solution, its pores should not be clogged, and in usingit, it should be applied to the spot to be removed with gentle pressure. Remember oxalic acid is poisonous.

(55) E. N. H. asks: What is the composition of Seidlitz powders, and in what proportions? A. The blue powder contains 1 drachm bicarbonate soda and 2 drachms Rochelle salts intimately mixed. The white powder is one-half drachm tartaric acid.

(56) E. S. asks how to electroplate articles that are non-conductors of electricity, such as leaves, fishes, insects, etc.? A. The leaf is carefully dried, and laid upon a smooth piece of milled lead, which is placed between two steel plates and passed between rollers; these press the leaf into the lead, and produce a complete mould. Copies from this may be taken with gutta-percha or electrotype. Roseleur describes the copying of nettle and other leaves so perfect that all the hairs on their surface were to be seen. One of the sides of a fresh leaf was covered by means of a brush with a thin paste of plaster of Paris, and after the drying of the first coat other layers were applied, until a resisting block had been obtained with the leaf uppermost. The free side was then covered with several coats, always with a brush or pencil of gutta-percha dissolved in carbon bisulphide, and lastly with melted gutta-percha. The mould was removed from the leaf, metallized, and immersed in the galvanoplastic bath. To cast reptiles, embed the subject in a mould made of four parts of plaster of Paris, one of unburnt lime powder, and one of Flanders' brick dust. Dry the mould carefully in an oven, then make it red hot, and burn the subject out of it, taking care to free the mould from the ashes. Fusible metal may be cast in this mould, or a wax model may be taken of the object, pouring the wax in just before setting. The whole is now placed in water, the lime causes the mould to dissolve or break up, and the figure modeled within it may be taken and covered with copper and the wax afterward melted out. Flowers, insects, lizards, or other small animals may be typed in this manner.

(57) G. M. asks for a method of crystallizing tin plate. A. Heat the plate until the tin begins to melt, and dip it into a solution of 1 part of bichromate of potassa in 3 parts of water, 2 parts of muriatic acid, and 1 part of nitric acid. After rinsing well, muriatic acid is poured over the tin plate, and then a solution of 10 parts hyposulphite of soda in 120 parts of water. The crystalline flowers produced thereby display a great variety of colors according to the time of contact. Rinse well with water, then with alcohol, and lastly lacquer.

(58) E. H. B.: The following is a good fireproof cement: 1. Iron filings, 140 parts; hydraulic lime, 20; quartz sand, 25; sal ammoniac, 3. These are formed into a paste with vinegar, and then applied. The cement is left to dry slowly before heating. 2. Iron filings, 180 parts; lime, 45; common salt, 8. These are worked into a paste with strong vinegar. The cement must be perfectly dry before being heated. By heating it becomes stone hard.

(59) J. C. asks If there is any process known by which we can dissolve india-rubber or gutta-percha? A. Use bisulphide of carbon: be careful not to use it near a light or fire.

(60) D. H. V. asks for the best method of cleaning bronze statuary or other bronze ornaments, in the fine lines of which dust has collected? In the ordinary process of dusting I have not been able to remove the dust so collected, and which causes such ornaments to assume a gray, dingy appearance. A. Use weak soapsuds or aqua ammonia.

(61) O. N. N. asks how to soften tin that has been hardened by being heated too often, so that it will not injure its plating properties? A. Melt it again and add a little antimony.

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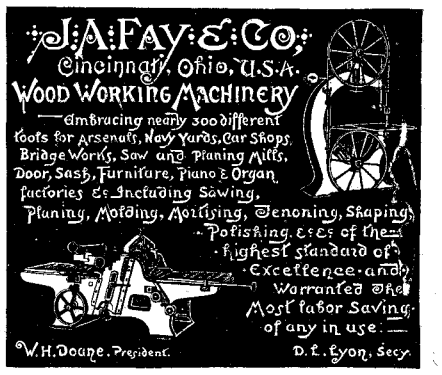
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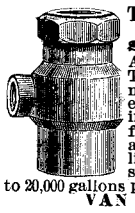
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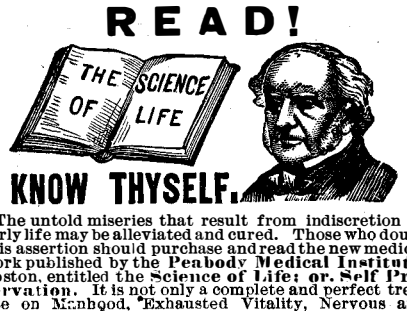

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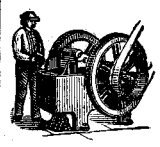

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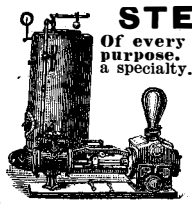

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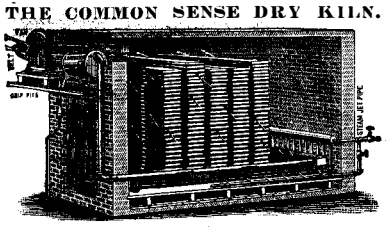

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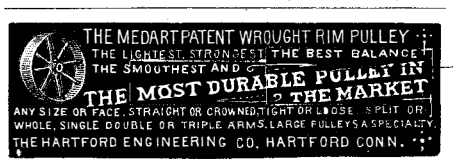
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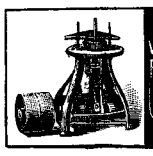

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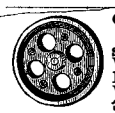

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The specifications will include the excavation for pump well, and all necessary masonry for foundations for well, also foundations of engine and engine house, also the erection of engine house for same.

The engine or engines to be of four millions (4,000,000) capacity, and to be of a guaranteed duty of not less than ninety millions (90,000,000) of foot pounds duty per one hundred (100) pounds of bituminous coal consumed, or such guaranteed duty as can be also had with the present boilers now in use at works.

The contractor must furnish specifications and detail drawings of type of engine and boilers to be furnished, also plan of well and pump house, the well to be so constructed that extra pumps can be placed therein when required.

The whole to be erected and completed, and in accordance with such plans as may be selected by the Superintendent of Water Works, and approved by the Water Committee and Councils of the City of Allegheny, Penna.

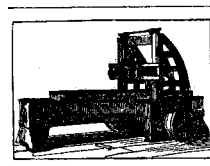
Contractors must specify when the work will be completed.

All information in regard to the above work will be furnished by Edward Armstrong, Supt. of Water Works, City Hall, Allegheny, Penna.

No proposal will be received unless accompanied with a bond equal in amount to the bid.

The Committee on Water reserves the right to accept or reject any or all bids.

JAMES A. BROWN,
Comptroller of the City of Allegheny.



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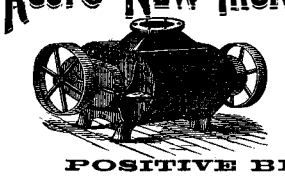

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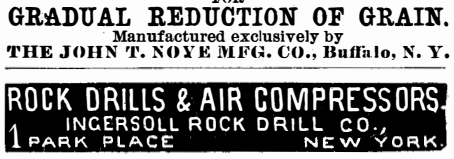

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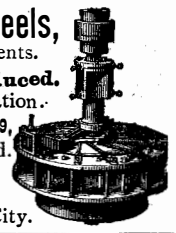

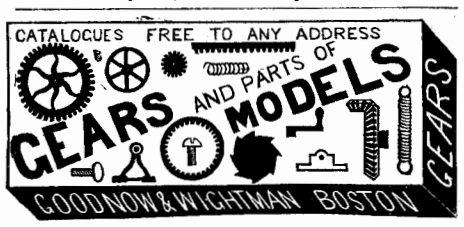

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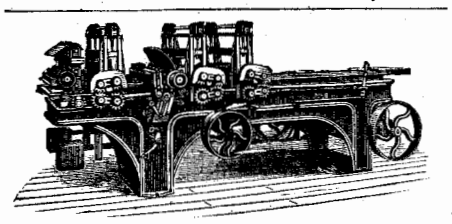

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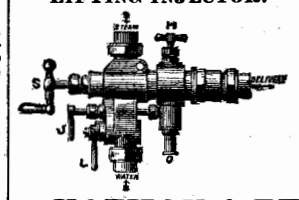

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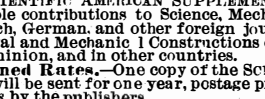

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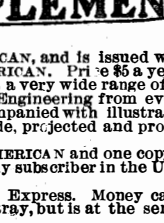

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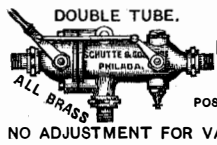

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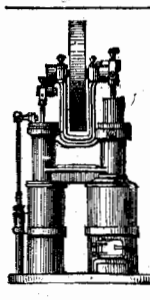

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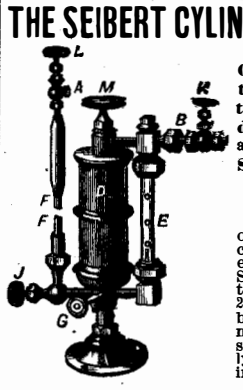

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